AD-A149 879 DEPLOYMENT AREA SELECTION AND LAND WITHDRAWAL/ACQUISITION CHAPTER 3 M-X/M.. (U) HENNINGSON DURHAM AND RICHARDSON SANTA BARBARA CA 02 OCT 81 1/5

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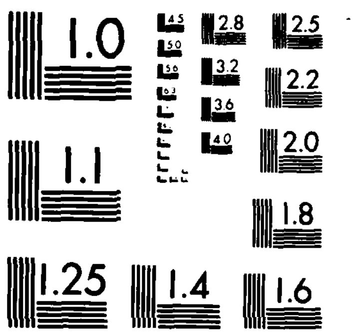

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

CHAPTER 3

VOLUME I

Prepared for

United States Air Force
Ballistic Missile Office
Norton Air Force Base
California

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Henningson, Durham & Richardson, Inc.
Santa Barbara, California

Review Copy of Work in Progress

2 October 1981

DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE ASSISTANT SECRETARY

Federal, State and Local Agencies

On October 2, 1981, the President announced his decision to complete production of the M-X missile, but cancelled the M-X Multiple Protective Shelter (MPS) basing system. The Air Force was, at the time of these decisions, working to prepare a Final Environmental Impact Statement (FEIS) for the MPS site selection process. These efforts have been terminated and the Air Force no longer intends to file a FEIS for the MPS system. However, the attached preliminary FEIS captures the environmental data and analysis in the document that was nearing completion when the President decided to deploy the system in a different manner.

The preliminary FEIS and associated technical reports represent an intensive effort at resource planning and development that may be of significant value to state and local agencies involved in future planning efforts in the study area. Therefore, in response to requests for environmental technical data from the Congress, federal agencies and the states involved, we have published limited copies of the document for their use. Other interested parties may obtain copies by contacting:

National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
Telephone: (703) 487-4650

Sincerely,

JAMES F. BOATRIGHT
Deputy Assistant Secretary
of the Air Force (Installations)

1 Attachment
Preliminary FEIS

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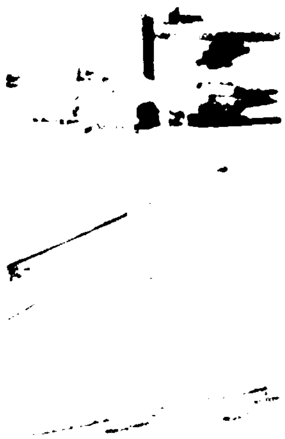
Affected Environment



INTRODUCTION

Chapter 3 presents a description of existing affected biological, physical, and socio-economic environmental characteristics in the Nevada/Utah, and Texas/New Mexico bi-state regions and operating base vicinities where M-X facilities may be located. The selection of environmental resources covered was determined as a result of critical issues identified during the scoping process and other means which are described in detail in Chapter 4. Geotechnically suitable land for the deployment of M-X in the Nevada/Utah region is shown in Figure 3.1-1. Geotechnically suitable land in the Texas/New Mexico region is shown in Figure 3.1-2. Environmental study area boundaries extend beyond the geotechnical limits. The extent to which environmental study areas exceeded the geotechnical limits varies according to the discipline under study.

The potentially affected Great Basin Environment is characterized by the above photograph with long north-south trending valleys with drainage ending in a playa.

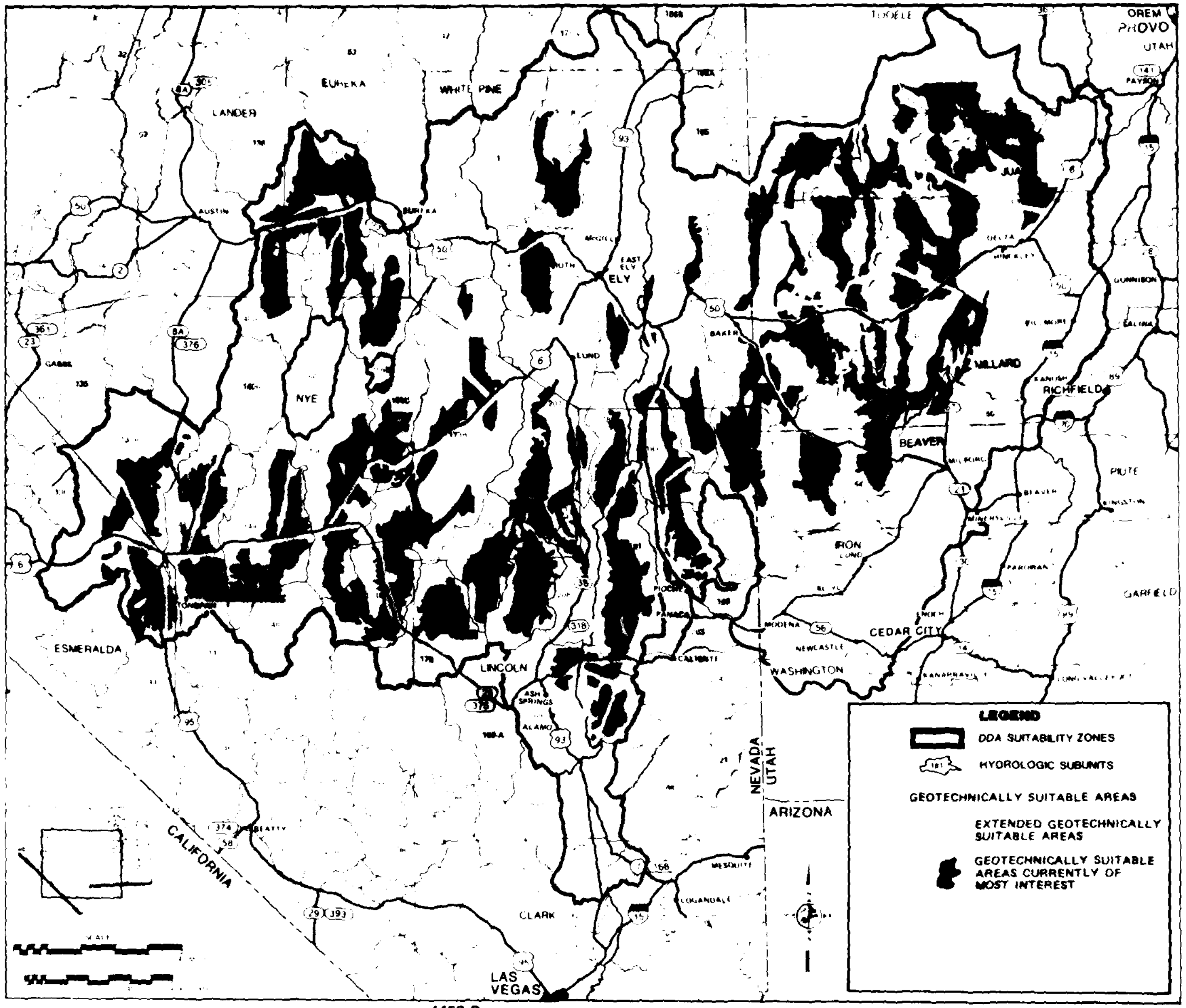


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Figure 3.1-1. Geotechnically suitable areas in the Nevada/Utah deployment region.

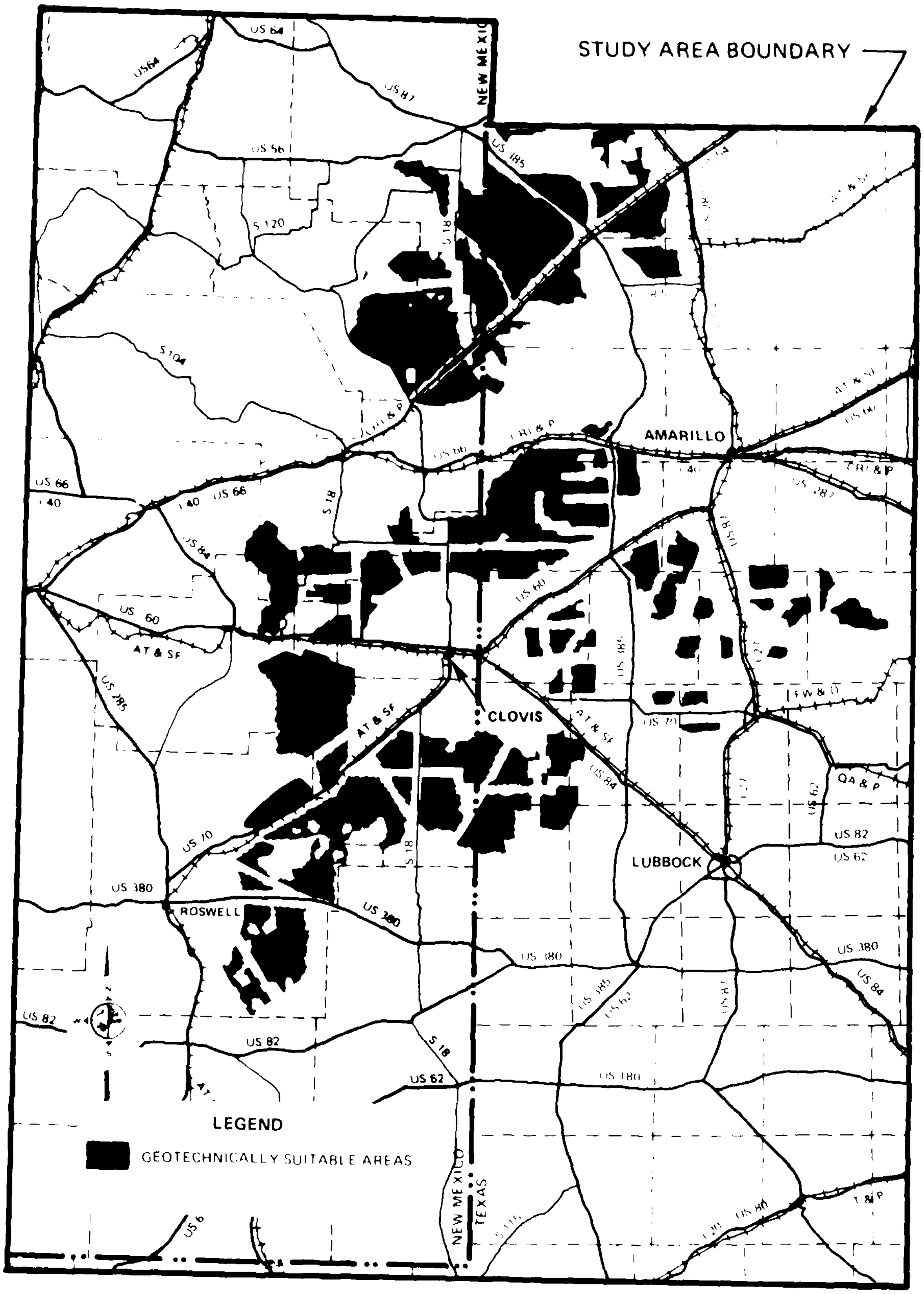

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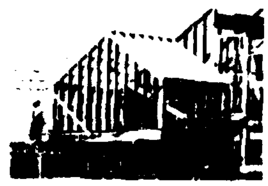
Figure 3.1-2. Geotechnically suitable areas in the Texas/New Mexico deployment region.

Regional Environment, Nevada/Utah



REGIONAL ENVIRONMENT, NEVADA/UTAH

The region is located in the Basin and Range Province, with north- and south-oriented mountain ranges separated by high desert valleys. Most valleys have an interior drainage system. As a result, broad playas and alkali flats are common. Terrain is rugged and relatively sparsely populated. Precipitation is minimal, averaging about 8 in./yr. Agriculture is limited. Main rural economic activities are mining and grazing.

The following sections describe the quality of life, and natural and human environmental characteristics of the Nevada/Utah area. Included are descriptions of physical and biological resources: Groundwater, Surface Water, Air Quality, Mining and Geology, Vegetation and Soils, Wildlife, Aquatic Species, Protected Species, and Wilderness and Significant Natural Areas. Discussion of the human environment covers: Employment, Income and Earnings, Public Finance, Population and Communities, Transportation, Energy, Land Ownership, Land Use, Native American Resources, Archaeological and Historical Resources, and Construction Resources.

DESCRIPTION OF OTHER PROJECTS

Future projections have been separated into Baseline 1 and Baseline 2. The differences between Baselines 1 and 2 are attributable to the inclusion of a number of projects in Baseline 2. These projects are primarily mineral extraction and processing and/or electrical energy production. High oil prices have encouraged the search for substitute fuels and technologies. In the study area, power plants using coal and, to a lesser extent, geothermal steam are the major anticipated energy production activities. Molybdenum and alunite mining also are potentially important within the ROI.

The Bureau of Economic and Business Research of the University of Utah, in consultation with the Nevada and Utah State Planning Coordinators Offices, has recommended that Baseline 1 (trend growth) specifically include:

- o continuation of 1967-1978 growth trends;
- o construction of Anaconda Nevada Molybdenum Project (Nye County);
- o metal mining in Eureka and White Pine counties;
- o expansion of oil and gas activity; and
- o mineral exploration in the Utah portion of the ROI.

(See University of Utah, Bureau of Economic and Business Research, "Refinement of Broad Area Impacts of M-X Missile Deployment on Nevada and Utah and Preliminary Allocation of Impacts to Community Group Level", August 13, 1980, pp. 2-3.)

Baseline 2 (high growth) specifically includes the following developments:

- o all the trend-growth activities of Baseline 1;
- o in White Pine County, the White Pine Power Project;
- o in Millard County:
  - Intermountain Power Project;
  - Continental Lime cement plant;
  - Brush Beryllium expansion;
  - Precision-Built Modular Homes;
- o in Juab County:
  - Martin-Marietta cement plant;
  - General Battery;
  - UFCO coal loading facility; and
- o in Beaver County:
  - geothermal power development;
  - molybdenum mining;
  - alunite mining and processing.

There is a degree of uncertainty regarding each of these Baseline 2 projects, though some may be more likely than others.

Other projects not assessed in this analysis include the following:

- o Allen-Warner Valley complex, including the following facilities:
  - Alton mine, southern Utah;
  - Warner Valley Power Plant, St. George, Utah;
  - Allen Power Plant, Clark County, Nevada;
  - coal slurry lines from mine to plants;
  - transmission lines from plants to southern California;
- o Rocky Mountain Pipeline, 1985;
- o Cove Fort Geothermal Power Plant, Millard County, Utah;
- o Reid Gardner Power Plant #4, Clark County, Nevada;
- o Mountain Fuel Coal Gasification Plant;
- o Valmy Power Plant, Valmy, Nevada; and
- o Mormon Mesa Solar Power Plant.

These projects did not receive treatment because a) their effects on employment were expected to be small, b) their probability of realization was deemed relatively low, or c) their principal effects were likely to occur outside the Nevada/Utah ROI.

County-level population projections (see ETR-27), labor force participation rates and unemployment rates are used to project employment by place of residence

using the labor force concept for each of the ROI counties from 1982 through 1994. These projections of regional employment, without M-X, are presented in Table 3.2-1 for Baseline 1, or "trend-growth" conditions, and in Table 3.2-2 for Baseline 2, or "high-growth" conditions. The trend-growth baseline projection represents a continuation of 1967-78 trends in the region. The high-growth projections include specific projects which are large relative to the local economies in which they would be constructed. These projections are presented through 1994--five years after construction of the M-X basing system would be complete and fully operational.

Under trend-growth conditions, employment in the 12-county Nevada/Utah ROI is projected to grow from 631,000 in 1982 to 871,000 in 1994. This represents average annual growth of 2.7 percent. Clark County is projected to lead the region in growth, from 219,000 jobs in 1982 to 331,000 jobs in 1994--growth of about 3.5 percent per year. Salt Lake and Utah counties are expected to grow more slowly, at approximately 2.3 percent annually. Among the more rural counties in the ROI, Iron and Washington counties are the two largest local job centers. Employment in these counties is projected to grow at a 2.4 percent annual rate for Iron County and a 2.9 percent rate for Washington County. Employment in Millard, Juab, Nye, and Lincoln counties is projected to grow at annual rates of 2.2, 2.5, 2.9, and 3.0 percent, respectively. More modest growth is projected for Eureka and Beaver counties--about 1.7 and 1.4 percent respectively. No significant growth is projected for White Pine County throughout this period under trend-growth conditions.

Table 3.2-2 presents Baseline 2 or high-growth employment projections for the Nevada/Utah ROI from 1982 through 1994. Over the long-term, the high-growth projections for the region as a whole differ very little from the trend-growth projections in Table 3.2-1. The long-term (1994) difference between the two projections is only 8,000 jobs. Differences between the two projections are larger during the years 1985 through 1988. During these years, the high-growth projections are approximately 11,000 to 12,000 jobs higher than the trend-growth projections.

In Nevada, major opportunities for development are anticipated in minerals and energy production, particularly in the rural counties. In the Nevada study area, four large projects are anticipated: the White Pine Power Project, reopening of Kennecott Copper Company mine near Ruth, and metal processing in McGill, all located in White Pine County; and the Anaconda Nevada Molybdenum Project in Nye County. Economic growth and changes will be pronounced in White Pine County from cumulative effects of the two projects there; employment growth is projected to equal as much as 5,800 jobs, over one-half of current county employment levels.

Fluctuations in the value of precious minerals can greatly affect the economics of Nevada's rural counties. Nevada mineral output dropped substantially from 1977 to 1978, largely because of the shutdown of Kennecott Copper Company mining operations in White Pine County. Depressed copper prices and increased production costs of meeting clean air regulations were the major factors in contributing toward this closure. In 1978, gold replaced copper as Nevada's leading mineral commodity for the first time in 50 years. Nevada ranked first in the nation in the production of barite, magnesite, and mercury, and second in gold.

Although mining employment in rural counties is a small percent of the total, the mining sector has major effects on other sectors of the economy, particularly

Table 3.2-1.

BASELINE 1 TREND-GROWTH EMPLOYMENT PROJECTIONS, NEVADA/UTAH ROI, 1982-1994

COUNTY	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
BEAVER	1955.	2006.	2062.	2120.	2147.	2167.	2186.	2206.	2224.	2249.	2274.	2297.	2316.
CLARK	218558.	226313.	234342.	242657.	251970.	261646.	271687.	282122.	292948.	302099.	311526.	321252.	331276.
EUREKA	644.	656.	668.	681.	690.	701.	717.	727.	743.	753.	764.	779.	790.
IRON	7623.	7864.	8136.	8425.	8637.	8838.	9047.	9262.	9479.	9653.	9832.	10005.	10167.
JUAB	2147.	2243.	2350.	2466.	2522.	2574.	2630.	2684.	2739.	2780.	2820.	2858.	2892.
LINCOLN	1690.	1741.	1793.	1847.	1900.	1956.	2017.	2077.	2137.	2202.	2271.	2335.	2409.
MILLARD	3678.	3834.	4004.	4188.	4285.	4377.	4473.	4568.	4663.	4703.	4739.	4772.	4796.
NYE	2883.	2983.	3082.	3182.	3275.	3372.	3470.	3573.	3679.	3773.	3868.	3968.	4068.
SALT LAKE/UTAH	380370.	394230.	409410.	425805.	434985.	443241.	451975.	460343.	468541.	476205.	483719.	490687.	497004.
WASHINGTON	8594.	8955.	9330.	9721.	9989.	10263.	10545.	10835.	11133.	11363.	11597.	11837.	12081.
WHITE PINE	2983.	2987.	2991.	2995.	2996.	3000.	3003.	3011.	3014.	3018.	3022.	3025.	3029.
DEPLOYMENT REGION	631124.	653811.	678167.	704087.	723397.	742134.	761749.	781406.	801301.	818798.	836431.	853815.	870827.

SOURCE HDR SCIENCES, BASED ON POPULATION, LABOR FORCE, AND UNEMPLOYMENT DATA FROM STATE SOURCES. CT

Table 3.2-2.

BASELINE2 HIGH-GROWTH EMPLOYMENT PROJECTIONS, NEVADA/UTAH ROI, 1982-1994

COUNTY	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
BEAVER	2749.	3637	4129.	4615.	5030	4207	4078.	4120.	4183.	4252	4320	4389.	4435.
CLARK	218648	226470.	234582.	243086.	252471	262152.	272152.	282504.	293277.	302446.	311888.	321631.	331670.
EUREKA	644.	656.	668.	681.	691.	701.	717	727	743	753.	764.	779.	790.
IRON	7638.	7894.	8179.	8488.	8709	8901.	9105	9313.	9525.	9700.	9881.	10053.	10217.
JUAB	2340.	2757.	3056.	3321.	3321	3376.	3341.	3206.	2995	3041.	3088	3132.	3168.
LINCOLN	1690.	1742.	1794.	1849.	1903.	1959.	2019	2079.	2139.	2203.	2273.	2338.	2411.
MILLARD	4556	4851.	6065	7177	7079.	7226.	7024.	6179.	5712	5768	5832	5888.	5936
NYE	2883.	2983.	3083.	3184.	3277	3374.	3471.	3574	3680.	3775.	3870.	3970	4070.
SALT LAKE/UTAH	380987.	395316.	411126.	428593.	438073.	446371.	454834.	462602	470371.	478129.	485730.	492763.	499181.
WASHINGTON	8594	8955.	9330.	9721.	9989.	10263.	10545.	10835.	11133	11363.	11597.	11837.	12081
WHITE PINE	2984.	2989.	3073.	4575.	5152.	5829.	5563.	4985	4598.	4644.	4697.	4732.	4778
DEPLOYMENT REGION	633712.	658249.	685084.	715289.	735694.	754359	772848.	790124	808356.	826075.	843939.	861511.	878737.

SOURCE HDR SCIENCES, BASED ON POPULATION, LABOR FORCE, AND UNEMPLOYMENT DATA FROM STATE SOURCES. SEE TEXT. CT

construction and manufacturing. In general, employment in the mining sector includes only mineral extraction. Ore concentration is included in the manufacturing sector except in certain cases where the ore concentration process is located on the mineral extraction site. Basic metals refining is normally included in the manufacturing sector.

Mining activities have strong backward linkages with the construction industry. Prior to development of a major mineral deposit, large numbers of construction workers may be required for mine construction and ancillary minerals-processing plants. These workers will require housing and other services, adding to the construction impacts.

Economic activity is highly concentrated in mining in Eureka, Lincoln, Nye, and White Pine counties. This concentration could well increase in the 1980-1990 decade, due to the recent escalation of the prices of gold, silver, and other precious metals. Future development of opportunities would likely stress minerals development.

Current economic activities have centered on mineral production possibilities in Nevada, particularly in the rural counties. Current minerals exploration in Nevada is proceeding at an annual rate of over $100 million, and $15 million is being spent on geothermal exploration. Although most geothermal exploration activities have occurred outside of the Nevada ROI counties, this may be more an indicator of feasible applications of geothermal energy than an indicator of potential geothermal supplies. Increased economic activities in the ROI counties would tend to operate together with increased exploration and development of geothermal resources.

In Utah, projected employment impacts of selected projects included in Baselines 1 and 2 mainly affect Beaver and Millard counties. In Beaver County, the Pine Grove Molybdenum Project is the primary source of the differences between Baseline 1 and Baseline 2. This molybdenum mining and milling development accounts for about 90 percent of the difference in jobs between Baseline 2 and Baseline 1 from 1982 through 1986, and about 40 percent thereafter. Alunite mining and processing account for about 60 percent of the difference between the two baselines after 1986. The Roosevelt Hot Springs geothermal project accounts for about 5-10 percent of the difference throughout the projection period.

The principal cause of the differences between trend-growth and high-growth projections in Millard County is the Intermountain Power Project. It accounts for about 80 percent of the difference between the two baselines after 1984. The Martin Marietta cement plant is the primary reason for the difference between the two baselines in 1982-83, and accounts for about 15 percent of the difference during the rest of the period.

Quality of Life

QUALITY OF LIFE

Quality of life evaluations are based upon a person's satisfaction with his way of life. While it is possible to quantify some aspects of the elements comprising a way of life--such as occupation, income, and leisure patterns--others are intangible, ranging from particular satisfaction in social relationships, personal and community values of life, to the infinite variety of experiences which represent the aggregation of personal satisfaction and values of people. In selecting illustrative examples there is the possibility of creating the impression that other social or occupational groupings have been overlooked, or not thought to have been worthy of mention; or that an individual satisfaction has not been considered. This is not the case, rather it is a question of using a few examples to indicate that a far wider range of cases and concerns of a very complex, diverse, and sensitive society have been considered in the decisionmaking process.

There would be impacts, both positive and adverse, to the quality of life of individuals and groups now resident in the impact areas and those who would come to construct and operate the system. The EIS recognizes these impacts would occur, and suggests ways in which some adjustments can be made to alleviate them. Essential to an understanding of the quality of life analysis is the natural setting within the regions being considered for deployment of the M-X system. This is the framework upon which is molded the life and values of those who have chosen to live in the areas. Underlying all considerations of the quality of life is an appreciation of the natural setting and its influence on the social and ecnomic aspects of life in the Great Basin and the lands of Texas/New Mexico.

The proposed Nevada/Utah deployment region falls into the Great Basin part of the Basin and Range Province of the Western United States. The Great Basin consists of north-south mountain ranges separated by valleys, many of which are closed basins. The central area of the Great Basin is characterized by valleys that are mostly 5,000 feet in altitude, none of which contain perennial lakes (Hunt, 1974:495).

The climate is arid, and acts as an important contributor to the region's physical ruggedness. There are few perennial streams. In the northern part of the

Great Basin, winters are cold, partly because of the northerly latitude and partly because of the high altitude. Summers are hot. The southern part has milder winters, but very hot summers (Hunt, 1974:509). Supplies of surface water and groundwater are meager, and in many of the basins both the surface water and the groundwater are saline (Hunt, 1974:510). A limited acreage in several basins in the central part of the Great Basin is irrigated with springs and groundwater. Irrigation is intensive and extensive along the eastern border of the Great Basin, where water is available from the Bear, Wever, Provo and Sevier rivers. These water supplies, initially utilized in the late 1840s by the Mormons, are highly developed (Hunt, 1974:511). The arid climate affects the vegetation, which tends to vary with both the amount of rainfall and the time and duration of the wetter season. Vegetation zones vary from scrub through grass and transitional woodland to forest.

In such an arid, rugged area, the means of making a living are limited. Indeed, Paterson identifies essentially four groups of occupations: mining, ranching and lumbering; irrigation farming; and travel and tourism (Paterson, 1975:276).

Many explorers and earliest settlers of the Great Basin were miners, and apart from the agricultural communities around Salt Lake, they made up the overwhelming majority of the population in the 1850s. The area has a history of mining boomtowns and subsequent busts, few of which have sustained continuous growth from their establishment until the present day. Some of the exceptions are Tonopah and Pioche in Nevada, and Cedar City (formerly known as Coal Creek) and Eureka in Utah. The history of mining is one of change, including the progressive discovery of new mineral ores (gold silver, lead, copper and zinc); the discovery of new uses for the rarer minerals, such as tungsten, molybdenum and uranium; and changing mineral production techniques (Paterson, 1975:276-280). Important mining districts today in the Great Basin include those around Tonopah (silver, magnesium, molybdenum), Pioche (lead, zinc), Ruth (copper), Iron Springs (iron) and Eureka (gold, silver) (Hunt, 1974:532).

Ranching, and to a much lesser extent lumbering and farming, are important. The greatest part of the region is covered with either dry grassland or open forest, and because these grade into one another without a natural break, one use affects the other. Two considerations limit use of these areas. First, since water is scarce, up to 100 acres or more may be required to feed one head of cattle in the driest parts of the Great Basin. Second, grazing in the open forest or on the alpine pastures above the tree line is possible only in summer, while the desert margins can be utilized only for a few weeks during the rainy season. In the past, these limitations contributed to overgrazing of the ranges and destruction of forest timber resources in higher elevations (Paterson, 1975:281).

The federal government is the landlord of most Great Basin land. The Bureau of Land Management (BLM) administers the rangelands, and the Forest Service the higher shrub- and forest-covered areas. The latter has traditionally emphasized logging and grazing under its multiple-use charge, although in recent years it has also extended its concern to the quality and quantity of recreational uses of the land, together with watershed control (Birdsall and Florin, 1978:284). The BLM and the Forest Service adjust the number of stock grazed to the varying condition of the range from month to month by controlling grazing permits (Paterson, 1975:281). Thus, ranching, and to a much more limited extent lumbering in the Great Basin, are conducted under constricted circumstances. Ranching is now the principal form of

land use in all but the highest and most rugged sections of the region (Paterson, 1975:281).

Farming in the Great Basin, limited by a combination of rugged terrain and widespread aridity, is mainly on irrigated land scattered throughout but principally in the southern edge of the Escalante Desert around Modena in Utah; around both Milford (Beaver Co.) and Delta (Millard Co.); in the Pahranagat Valley in Lincoln County, Nevada; and near Cedar City and St. George, Utah.

The transport-related industry also figures very prominently in the Great Basin region. Construction and operation of western railroads dominated the settlement period. Towns were sited primarily for convenience of the railroads; only gradually did they develop functions that linked them with their surroundings. An excellent modern day example is Caliente, in Lincoln County, Nevada, which has a Union Pacific maintenance center and classification yard. When the era of road travel came in, the same pattern was repeated. Roads were built to cross the area rather than to serve local towns. Service points for vehicular traffic sprang up along them since, despite the desire to pass through as quickly as possible, the great distances required development of facilities to serve travelers (Birdsall and Florin, 1978:289). Today, road maintenance and provision of gasoline, food, and lodging for travelers and tourists is an important industry (Paterson, 1975:285-287).

Much of the discussion in this and other sections of the EIS is on land use. But just as important as uses of land is what has been called its "non-uses" (Paterson, 1975:288). Undeveloped and undisturbed land which sustains little or no direct economic activity still services a variety of functions, ranging widely from watershed protection and preservation of examples of different ecosystems to wildland recreation and appreciation. Protection of certain lands for these functions culminated in the passage of the Wilderness Act of 1964, which gave legal standing to the concept of "wilderness" and the functions it serves.

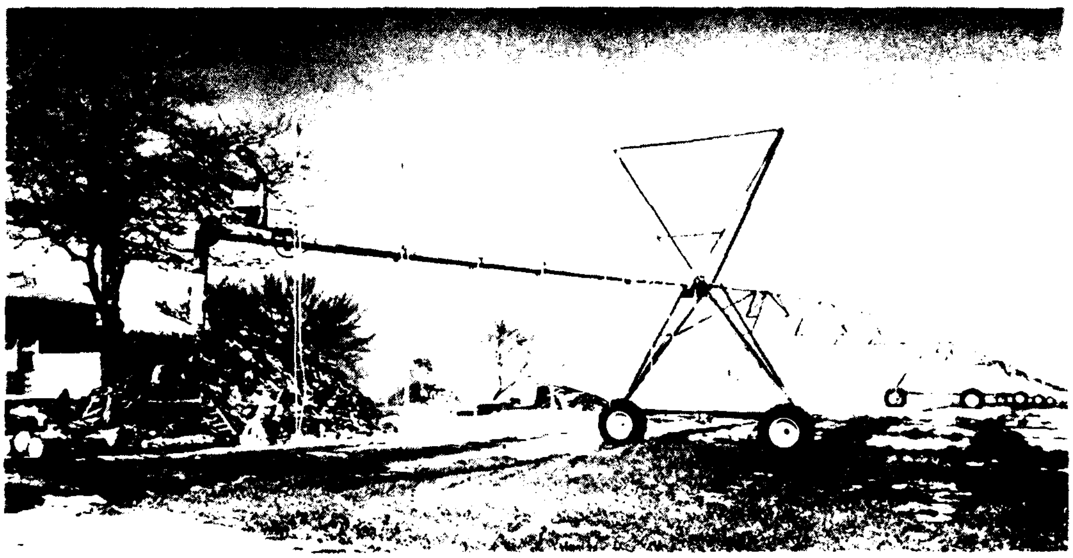
The concept of "wilderness" has taken on religious qualities for some Americans (Patterson, 1975), reflecting the increasing interest of urban residents to recreate in wildlands and by the growing realization that much natural wealth and beauty have already been destroyed. Strong pressure groups have emerged to champion preservation of selected lands as nature reserves. In the Great Basin, much of this pressure comes from urban grous outside the region. The pressure for additional natural reserve areas is especially aggravating to people in the area who are concerned about even more restrictive controls on some federal land.

No description of the Great Basin would be complete without mention of the Church of Jesus Christ of Latter-Day Saints or, more commonly, the Mormons, for they were extremely influential in settling the region. Their cohesive and readily distinguishable culture is manifest in various social patterns, economic organization, and development; and a strong belief in cooperation and support within the church has made the church a central influence on the regional way of life (White, et al, 1979:393). Although the Morman dream of a state of Deseret has not been realized, their culture region as expressed in the settlement landscape and economic activities, is one of the more internally homogeneous in the country (Zelinsky, 1973:131).

The Mormons were the first to encounter and solve many of the problems of living in the interior West. Their solutions were later freely adopted by non-

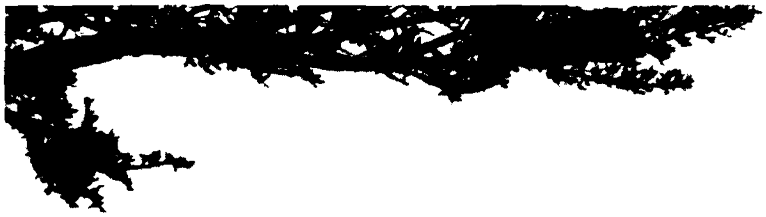
Mormons, with irrigation perhaps the best example. With theocracy providing the needed strong organization, they constructed a number of large-scale irrigation projects, first in the Wasatch Valley, and later elsewhere in the culture region. Mormons today make up two thirds of the population of Utah (and hold most public offices) and substantial populations in Nevada. The influence of the Mormon Church is felt throughout the Tier 1 siting area, especially its easternmost parts (Birdsall and Florin, 1978:284-285).

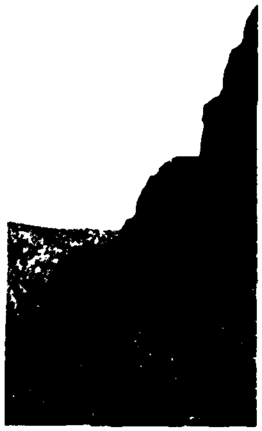
In summary, the region's economy is based partly on primary production, especially pastoralism, mining, and irrigated agriculture, and partly on such tertiary activities as tourism and government expenditures. Where water is available and land is sufficiently level, as in the easternmost part of the area, intensive farming prevails as an oasis type of development. It is an area of sparse settlement. Much of the population is in small, tightly knit communities or individual homesteads spread over vast open spaces. There is a quality of outdoors ruggedness that greatly appeals to its residents. To many, it is a delightful place to live, but a difficult one in which to earn a living (Birdsall and Florin, 1978:294). These feelings are borne out by a recent survey conducted in Nevada, where the respondents defined their lifestyle values as centering on open space, climate, and relaxed lifestyles (Governor's Commission, 1980:8-9).



The non-urban Nevada/Utah region's economy is based upon agriculture, mining and tourism. The communities are close knit with a strong quality of outdoors ruggedness that appeals to residents.

Natural Environment





NATURAL ENVIRONMENT

The following sections describe important physical and biological resources in the Nevada/Utah study area. Resources described include: Water, Erosion, Air, Mining and Geology, Vegetation and Soils, Wildlife, Aquatic Species, Protected Species, and Wilderness and Significant Natural Areas.

Water Resources (3.2.2.1)

Groundwater Resources (3.2.2.1.1)

Introduction

The areas proposed for M-X deployment in Nevada and Utah are in the Great Basin Region, which is a large physiographic province that includes parts of California, Idaho and Wyoming. Generally, it is characterized by north-south trending mountain ranges, regularly spaced at intervals of 15 to 25 miles. Broad valleys, separating the ranges, represent block faulted depressions, and are partly filled with predominantly alluvial materials eroded and transported from the adjacent mountains and deposited in the valleys by flowing surface water. Many of the valleys in the region are topographically closed, meaning they are surrounded on all sides by a drainage divide. Consequently, there is no surface flow across the boundaries of the basin. Closed valleys with respect to surface flow may not be closed with respect to groundwater flow, as will be discussed later.

Other valleys in the region have surface drainage continuity with adjacent valleys and drain into terminal lakes or sinks. These sinks are also areas of regional groundwater discharge. The White River system (See Fig. 3.4.2.2-1) lies within the DDA and it is made up of a series of intermountain valleys, some of which contribute surface drainage to the Colorado River Basin to the south of the project area.

Figure 3.2.2.1-1 is a generalized representation of the hydrologic cycle applicable to the Great Basin Region. Surface and groundwater in the region originate as precipitation (rain or snow), most of which falls in the mountainous areas. Maximum precipitation events occur more frequently in April and May in the north and in July and August in the south. Occurrence, amount, and type of precipitation are related to topographic orientation and elevation. Average annual precipitation ranges from 4 in. in lower valley floors to more than 16 in. in higher

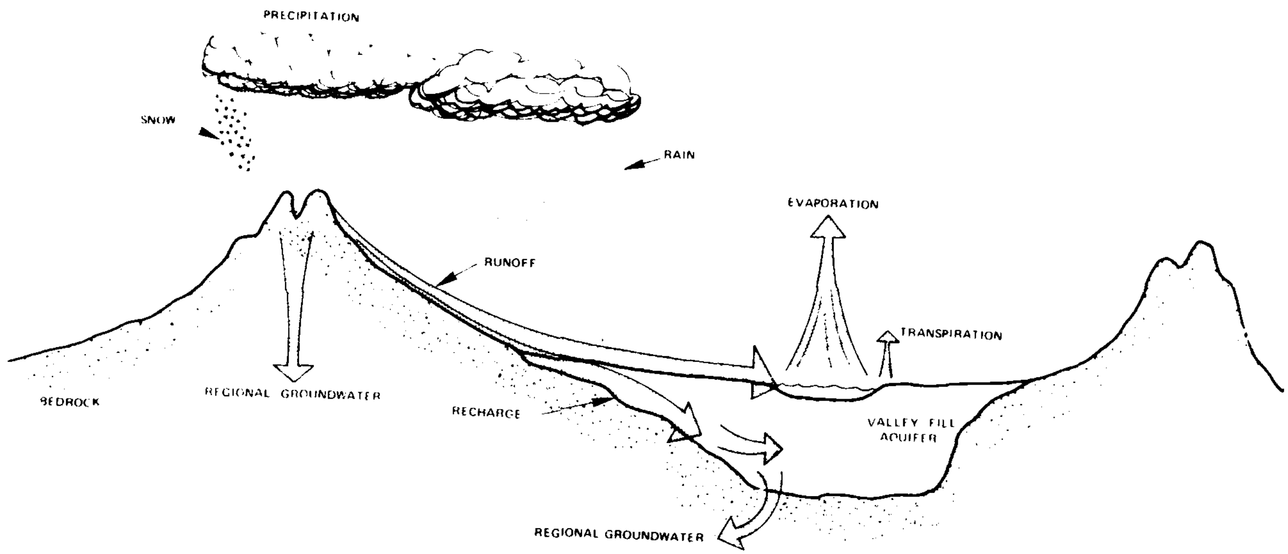


Figure 3.2.2.1-1. The hydrologic cycle.

mountain ranges. Snow provides a significant portion of precipitation. In areas of significant snowfall, snowmelt accounts for most of the groundwater recharge from precipitation. Snowfall averages between 10 and 40 in. on valley floors, and can exceed 80 in. in some mountains. Assumed values for precipitation as a function of elevation in the White River area, Nevada are presented in Table 3.2.2.1-1.

Groundwater recharge can occur in the mountains or in the valleys. In the mountains, streams may lose water by infiltration into fractured permeable bedrock; in the valleys, infiltration occurs into the valley fill alluvium. Most precipitation, however, evaporates in the mountains and alluvial slopes before infiltration occurs. The remainder adds to the soil moisture, with some reaching lowland areas. In the process, only a very small percentage actually finds its way to the groundwater reservoir. In most valleys in the project area, precipitation quantities are rather small, and infiltration to the groundwater reservoir is generally minimal.

Eakin (1951) estimated the potential recharge in the region. The method used in the determination assumed that for any given altitude zone, a percentage of total precipitation potentially recharges the groundwater reservoir, with that percentage depending on the average amount of precipitation within the zone. Generally, only between three and seven percent of the total precipitation falling on the Great Basin serves as groundwater recharge (Eakin, et al., 1976). Assumed percentages of annual precipitation serving as groundwater recharge in the White River area are presented in Table 3.2.2.1-1 (Eakin, 1966.).

Additional water is lost from the Great Basin by evaporation of shallow groundwater and transpiration from phreatophytes (deep-rooted plants) which commonly grow in areas of groundwater discharge. A review of hydrologic reconnaissance reports shows surface water evaporation rate estimates range from 3.5 to 5 ft per year. The transpiration rate is estimated at 0.1 ft per year in areas of scattered vegetation and up to 1.5 ft per year for wetlands and springs.

The Geologic Framework

Figure 3.2.2.1-2 presents a generalized valley cross-section showing common geologic features and relationships for valleys within the Great Basin Region. Table 3.2.2.1-2 summarizes the lithology and water-bearing characteristics of commonly occurring geologic materials in the Great Basin. Paleozoic carbonate rocks underlie much of the region to considerable depth and also are exposed in many mountain ranges (Kellog, 1963; Marcantel,1975). These carbonate rocks are primarily limestone and dolomite, that have been complexly folded and fractured. As a result, the carbonate rocks are capable of transmitting and storing considerable quantities of water within numerous fractures and solution channels. However, in many instances these groundwater reservoirs are disrupted by faults, making them discontinuous and often difficult to evaluate.

The water-storage and transmitting properties of these units are in many cases highly dependent on the extent and nature of localized fracture zones and solution openings, and are similarly difficult to evaluate hydrologically. On a regional scale, however, carbonate rocks in many areas of the Great Basin are highly permeable and are capable of yielding large quantities of water to wells (Eakin and others, 1976).

Volcanic rocks, in some areas, have sufficient fracture-related permeability to store and transmit large quantities of water. Quaternary and Tertiary volcanics are

Table 3.2.2.1-1. Assumed values for precipitation and percent recharge for several altitude zones in the White River area of Nevada.

Precipitation Zone (in.)	Altitude Zone (ft)	Assumed Average Annual Precipitation (in.)	Assumed Average Annual Recharge to Groundwater, Percent of Average Precipitation
Less than 8	Below 6,000	Variable	Negligible
8 to 12	6,000 to 7,000	10.0	3
12 to 15	7,000 to 8,000	13.4	7
15 to 20	8,000 to 9,000	17.5	15
More than 20	More than 9,000	21.0	25

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Source: Eakin, 1966.

Limited perched groundwater in the Escalante desert has often been drawn up by windmills. This location is just south of the Milford OB site.

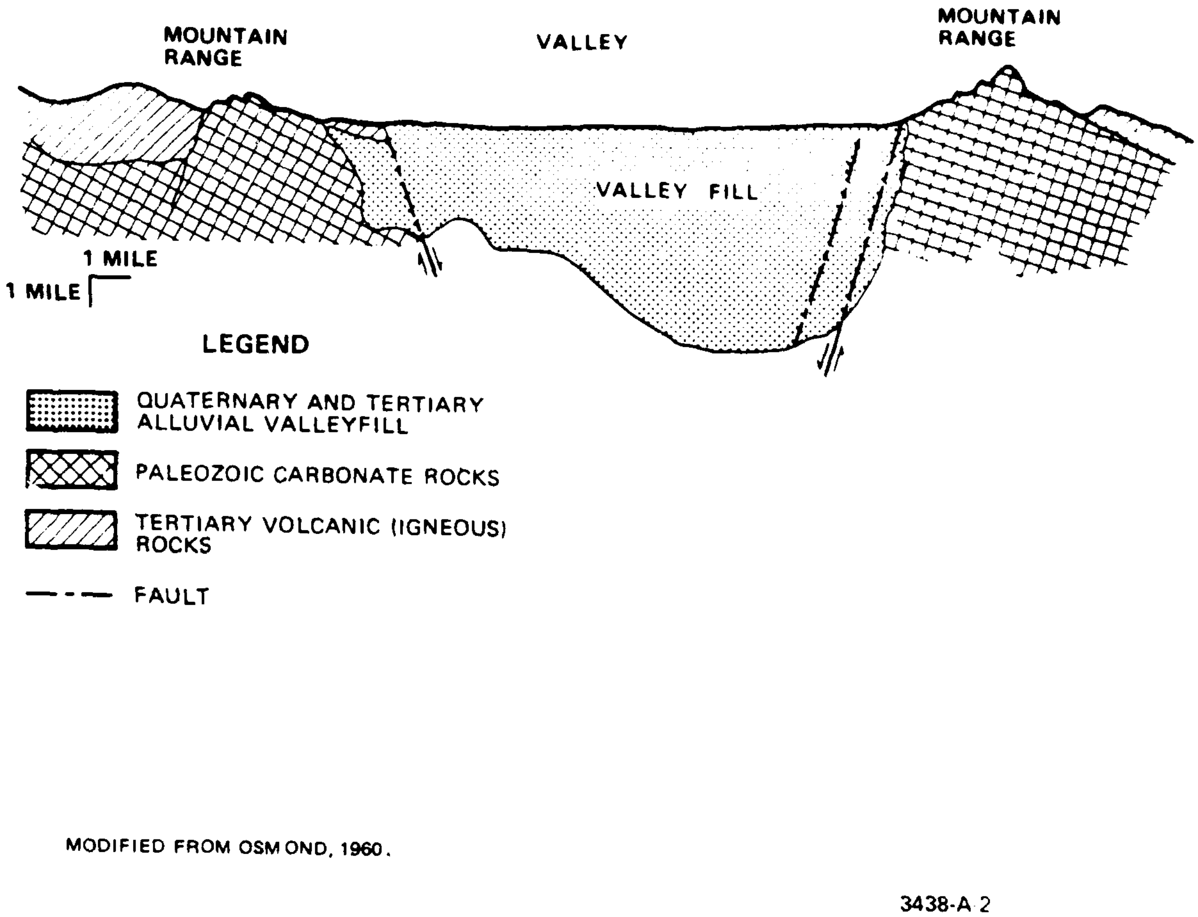

Figure 3.2.2.1-2. Generalized valley cross section showing basin and range geology.

Table 3.2.2.1-2. Generalized lithology and water-bearing characteristics of hydrogeologic units in the Great Basin (Page 1 of 2)

Age	Hydrologic Unit	Lithology	Water-Bearing Characteristics
Cenozoic Quaternary Valley Fill	Eolian dune sand	Composed mainly of fine to medium quartzose sand.	Permeable, retaining sufficient moisture to support vegetation. Generally unsaturated but locally may contain fresh perched ground-water during the spring or early summer: may transmit water to under-lying hydrogeologic units.
	Lacustrine deposits (playa)	Lakebed clay, silt, and evaporites.	Permeability generally low. Most precipitation and runoff reaching playa remains ponded until it evaporates. At such time, the thin playa deposits may be saturated for short periods. Locally may confine water in underlying aquifer.
	Stream-Channel alluvium	Mainly sand and gravel, but includes some clay and silt. Present as channel fill along larger streams.	Generally moderately permeable. Most deposits are saturated to or within a few inches of land surface during and for short periods following runoff, but water levels may be several feet below land surface and thinner sec-tions may be dry during much of the summer.
	Alluvium and Colluvium	Mainly sand, gravel, and boulders with intermixed and interbedded clay and silt. Forms in streams channels and near mount-ains, with coalescing alluvial-fan deposits along lower mountain slopes. Colluvial depos-its of angular rock fragments locally on higher mountain slopes.	Moderately to highly permeable but too thin to store significant quan-tities of water: most unsaturated, only thickest deposits may be sat-urated in lower areas: accepts re-charge from snowmelt, transmitting water to underlying hydrogeologic units; this and the underlying older alluvium comprise an aquifer along mountain fronts.

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Table 3.2.2.1-2. Generalized lithology and water-bearing characteristics of hydrogeologic units in the Great Basin (Page 2 of 2).

Age	Hydrologic Unit	Lithology	Water-Bearing Characteristics
	Older alluvium	Materials ranging in size from clay through boulders, intermixed and interbedded unconsolidated to well cemented. Probably include some lacustrine deposits and colluvium, but consists primarily of alluvium. Underlies younger deposits throughout most of region; grades upward into younger alluvium and lacustrine deposits along valley margins. Interbedded with extrusive igneous rocks in some valleys.	Slightly to highly permeable, depending on size and degree of sorting of materials and degree of cementation in individual strata. This unit forms the bulk of the valley fill, which is the major groundwater reservoir in most valleys.
Cenozoic Tertiary Valley Fill	Igneous rocks	Includes laza flows, ignimbriates, tuffs and braccias mainly in the mountain ranges. Interlayered locally with older alluvium in the subsurface.	Primary permeability generally very low. Where fractured or broken by faulting secondary permeability may be high. Yields water to springs in many areas where fractured. Accepts recharge where fractured and transmits water to adjacent or underlying hydrogeologic units.
Paleozoic Cambrian to Pennsylvanian	Consolidated carbonate rocks, undifferentiated	Mainly limestone and dolomite with some shale, siltstone, and sandstone. Complexly folded and faulted. Probably underlies most of eastern Nevada and western Utah at depth.	Primary permeability is low. Secondary permeability is moderate to high where solution openings are present, especially along bedding planes, fractures and faults. Most groundwater recharge is absorbed by these rocks where they crop out in the mountains and moves downgradient along bedding planes and fractures to discharge areas. The carbonate rocks probably serve as the principal conduit for groundwater movement in the basins.

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Source: Osmond, 1960

present at or near the surface in large areas throughout the Great Basin. Volcanic rocks are also found at depth in some valleys where they are interbedded with valley fill alluvium.

Groundwater in volcanic rocks often sustains perennial flow in streams and springs that occur along bedrock-alluvium contacts. At the Nevada Test Site in southern Nevada, volcanic rocks at depth (primarily Tertiary rhyolite lavas and ashflow tuffs) transmit groundwater through highly complex fracture systems (Blankennagal and Weir, 1973). Pump testing in these units yielded an average transmissivity of 10,000 gal/day/ft (1,337 cu ft/day/ft). However, only three to ten percent of the saturated intervals penetrated in test holes had measurable fracture permeability (Blankannagal and Weir, 1973).

Valley fill groundwater reservoirs are composed of alluvial deposits of the Quaternary, and older, which partly fill the depressions between the block-faulted mountain ranges of the region. These deposits contain sand and gravel aquifers which, in many areas, represent the only source of groundwater capable of sustaining relatively large scale development (Eakin and others, 1976).

Many valleys have discharging playas and the water table is relatively close to the surface in the lower elevations, with the depth to water increasing toward the mountains. In other valleys the water table is at great depth (several hundred to one-thousand feet) below the topographically low areas and no groundwater discharges from the playas. Particularly in the lower portions of valleys, water may occur under artesian (confined) conditions where fine grained, relatively impermeable silt and clay layers are fairly extensive and confine groundwater in underlying more permeable deposits. In numerous valleys, springs issue from the alluvium and bedrock in fault zones along the valley margins. Other springs discharge from the mountain fronts and the lower portions of the alluvial fans.

Valley fill aquifers in the Great Basin store large volumes of water. Typically, the volume of economically recoverable water in aquifer storage exceeds, by several hundred times, the volume of groundwater recharge and discharge in a valley in any given year. The U.S. Geological Survey has published estimates of the volumes of recoverable groundwater in transient storage in valley-fill aquifers of the Great Basin (Eakin, 1976). These estimates are used in this report as one basis for characterizing the region's groundwater resources and for impact assessment.

Groundwater Flow Systems

Groundwater flow takes place from areas of groundwater recharge to areas of groundwater discharge. In the Great Basin Region, mountainous areas often represent areas of net groundwater recharge. Lowland areas between mountain ranges often are areas of natural groundwater discharge. Maxey (1968) identifies and discusses two general categories of groundwater flow systems in the Great Basin as local flow systems and regional flow systems. Local flow systems are generally confined within the limits of one drainage basin and thus the lengths of flow paths between recharge and discharge areas are short. Regional groundwater flow systems can extend across two or more topographic basins. Flow paths are consequently relatively long, and interbasin transfer of groundwater occurs.

The theory and concept of idealized groundwater flow systems were developed by Hubbert (1940) and more recently by Toth (1962 and 1963). Hubbert and Toth point

out that the configuration of local and regional flow systems, particularly in humid zones, is largely controlled by topography. Thus, upland areas typically represent regions of groundwater recharge, and flow is predominantly vertically downward; lowland areas serve as groundwater discharge zones where vertically upward flow occurs. Between recharge and discharge zones, flow can be lateral or nearly horizontal.

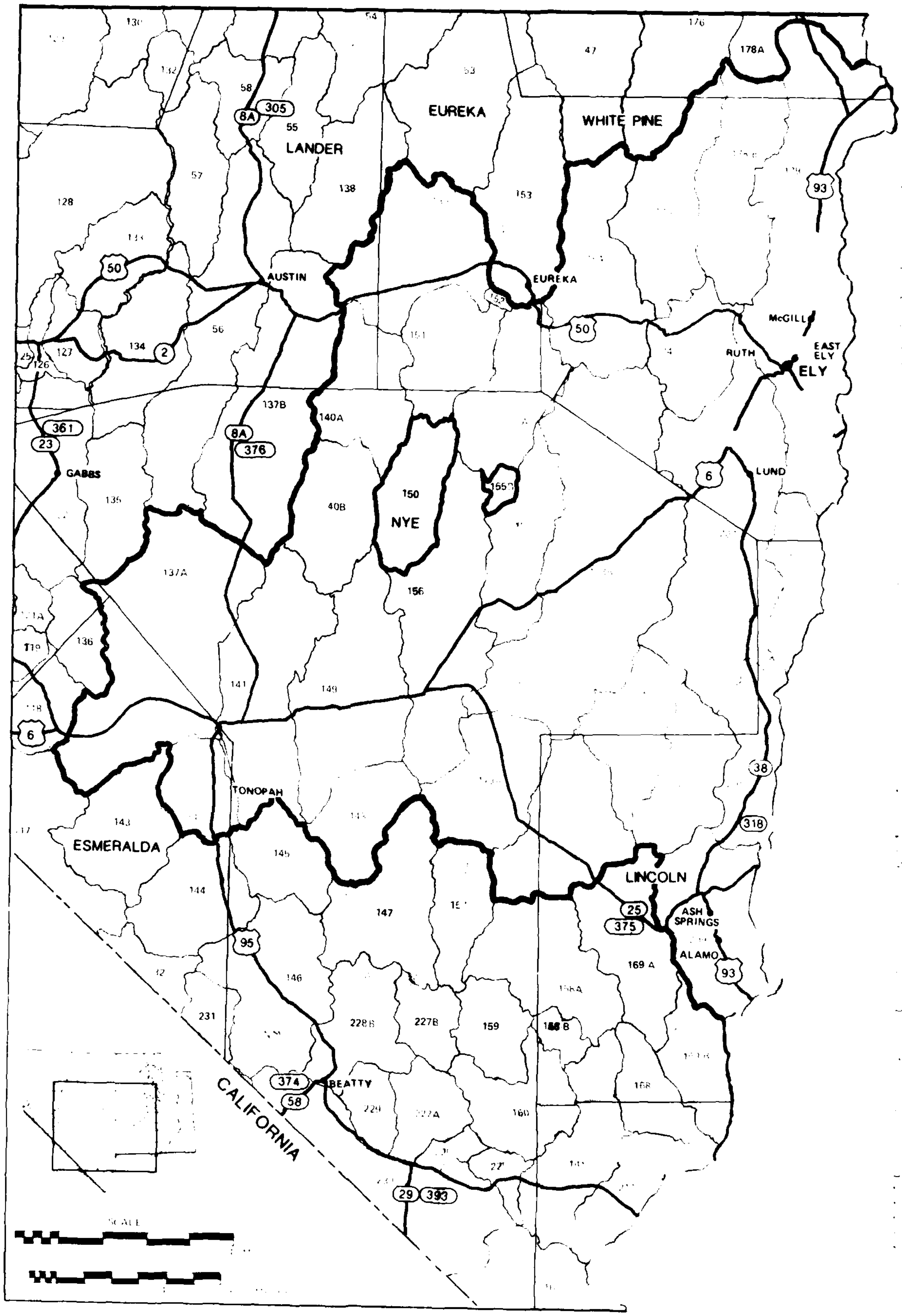
Maxey (1968) confirms that flow systems in the arid Great Basin are, in a general sense, remarkably similar to those discussed by Hubbert and Toth. This is the case in spite of the great diversity of the geologic framework through which groundwater flows in the Great Basin Province. The idealized flow system models conceptualized by Hubbert and Toth are valid for flow in a saturated porous medium which is isotropic and homogeneous, or uniform in all directions. Maxey maintains, however, that the scale of the flow systems in the Great Basin tends to minimize the influence of the geologic heterogeneities on groundwater flow. In general, the geologic heterogeneities are local in effect, and do not appreciably alter the regional flow systems, though local flow systems may in some cases be strongly influenced by geologic discontinuities (Maxey, 1968).

It is therefore, important to appreciate that, in the Great Basin, even local groundwater flow systems extend across the boundaries between different geologic units. Geologic factors modify and exert local influences on groundwater flow, but the flow systems are rarely limited or defined by a particular valley fill aquifer or carbonate aquifer. Rather, the location and nature of groundwater recharge areas and topographic controls are the most critical factors influencing the configuration of groundwater flow systems in the Great Basin.

Thus, groundwater withdrawals from one aquifer may influence the occurrence and movement of groundwater in another aquifer which is within the same overall flow system. Conversely, regional groundwater flow systems may or may not be hydraulically connected to local flow systems occuring in the same drainage area (Maxey, 1968). For example, groundwater withdrawals may have immediate effects on certain spring flows, but have no effect on other springs which are discharging from the same aquifer, because the latter represent discharge from a separate groundwater flow system. As pumping continues, however, new hydraulic gradients will develop and alter the groundwater flow regime, and flow systems that were independent under natural conditions may co-mingle as water from aquifer storage or natural groundwater discharge is diverted to the withdrawal well(s). Figure 3.2.2.1-3 shows a very generalized representation of regional groundwater flow in the Great Basin.

The factors that control the occurrence and movement of groundwater are complex and unique in each case. Many of these factors also influence the responses of the hydrologic system to groundwater withdrawals. The nature and severity of impacts which result from groundwater development activities are in large part controlled by the hydraulic responses of the aquifer to water withdrawals. The important factors that control hydraulic responses to withdrawals were summarized by Theis (1940) as follows:

1. The distance from the withdrawal well(s) to zones of natural groundwater recharge and discharge, and the magnitude and character of the natural recharge and discharge.



EUREKA
WHITE PINE
LANDER
AUSTIN
EUREKA
McGILL
EAST ELY
RUTH
ELY
GABBS
LUND
NYE
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
ALAMO
BEATTY
CALIFORNIA
SCALE

4459-D

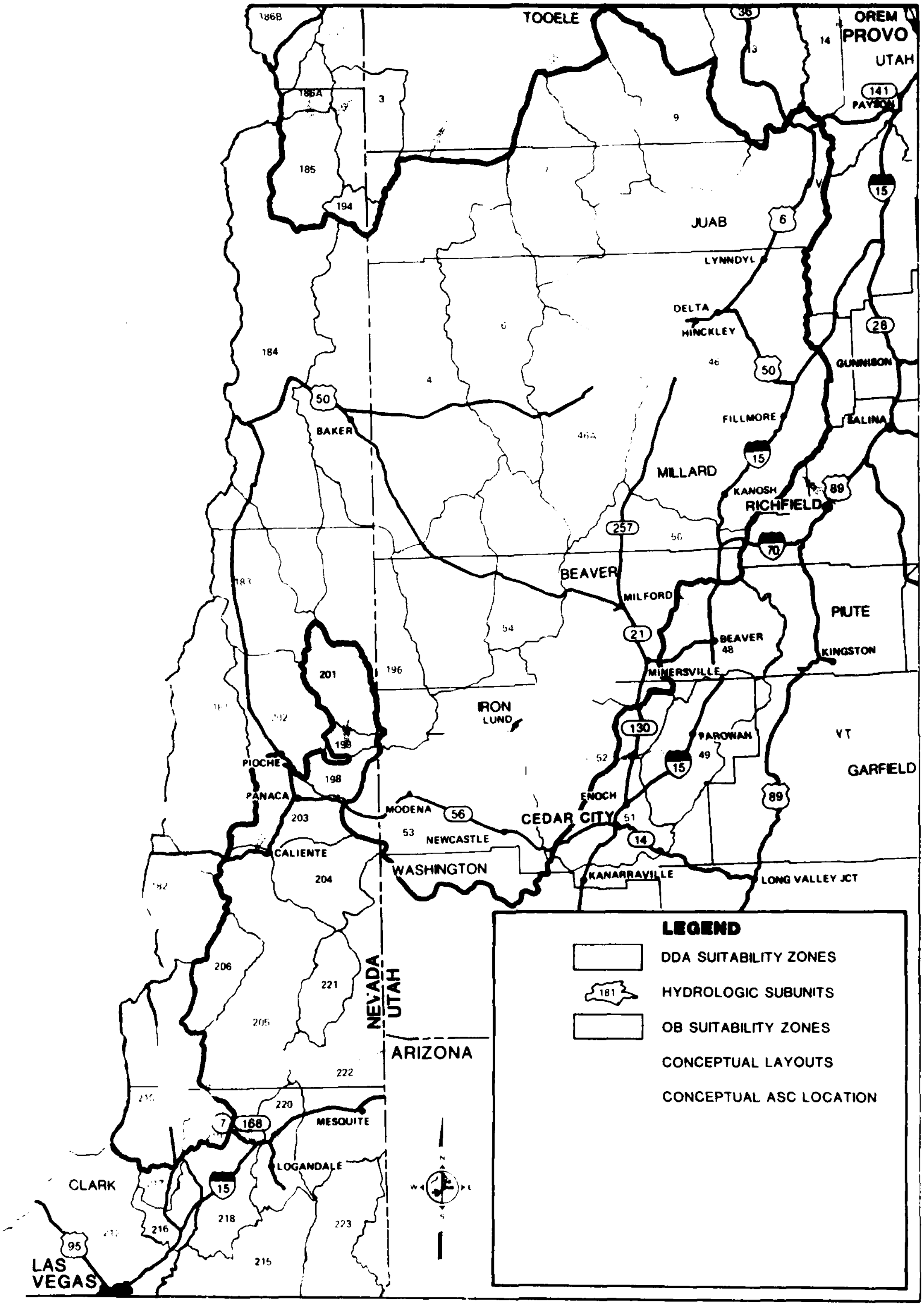


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Figure 3.2.2.1-3. Regional groundwater flow in the Great Basin.

2. The ease with which the source aquifer transmits water when a hydraulic gradient exists (measured by the coefficient of transmissibility or transmissivity), and

3. The ability of the source aquifer to release water from storage as head falls (measured by the storage coefficient).

Thus, forecasting impacts resulting from groundwater withdrawals requires both an understanding of the groundwater flow system,and where within that flow system withdrawals will be made. In addition, knowledge of aquifer performance coefficients, which are a measure of the earth material's ability to store and transmit water, is necessary.

Aquifer Storage and Perennial Yield

Groundwater flow velocities generally range between a few tens of feet to a few hundreds of feet per year. The velocity is controlled by the hydraulic gradient driving the flow and the permeability and porosity of the earth materials along the flow path. Under natural conditions, prior to groundwater development with wells, groundwater flow systems are in a state of dynamic equilibrium. Average annual groundwater recharge to the system is balanced by an equal amount of natural groundwater discharge and the volume of water in aquifer storage remains essentially unchanged (Theis, 1940). Development with wells represents a new discharge from a previously stable system and creates an imbalance between recharge to, and discharge from, the system. The extra discharge may be derived from a loss in the volume of water in aquifer storage, a decrease in natural groundwater discharge, an increase in groundwater recharge, or a combination of all three. Generally, in arid areas like the Great Basin region, appreciable amounts of additional recharge can not be induced by withdrawal of groundwater (Eakin, 1976). Consequently, water discharged by wells represents a combination of depleted aquifer storage and intercepted natural groundwater discharge, both of which lead to unique environmental impacts which will be discussed later in Chapter 4.

It is important to appreciate, however, that water discharged from a well is always to some extent, and in many situations, largely derived from depletions in aquifer storage. As pumping continues, the well's zone-of-influence in the aquifer expands, and water is diverted from a progressively larger and larger volume of aquifer. After sufficient time, the zone-of-influence may reach an area of natural groundwater discharge, or recharge, and additional withdrawals will be satisfied, all or in part, by a decrease in natural discharge or the interception of additional recharge. If sufficient natural discharge or additional recharge can be captured to meet the well's discharge capacity, then a new equilibrium may be established, and subsequent withdrawals will not result in further depletion of aquifer storage. Otherwise the well's zone-of-influence continues to expand until sufficient natural discharge has been intercepted and diverted to the well, or until impervious ("no flow") boundaries have been encountered, in which case the zone-of-influence deepens through the thickness of the aquifer.

The concept of "perennial yield," or its close equivalent "safe yield," is an idea that hydrologists, water resource managers, and administrators have struggled to define for more than 60 years. The idea behind "perennial yield" was that prior to groundwater development in a basin, (or even after development) hydrologists should

be able to evaluate the area and determine the volume of water that could safely be withdrawn, year after year, without an unacceptable depletion of the supply. The thought was that one could assign a number to the "perennial yield" or "safe yield" of the groundwater reservoir, without regard to how the development takes place. It has long been recognized by hydrologists, however, that safe yield will vary depending on where withdrawals are made within the flow system, and how the wells are designed (Thomas, 1951).

An additional problem in defining and quantifying "perennial yield" has been encountered in trying to determine what constitutes an "acceptable" depletion in the groundwater supply. As already discussed, all groundwater development results in some depletion of aquifer storage. What constitutes "acceptable" for depletion is controlled by a diverse and complex group of social, economic, and legal factors, which are in no sense static or fixed in time and space. Thus, while at first the concept of "perennial yield" seems simple and straightforward, it should never be viewed as a hydrologic parameter which can be defined or quantified with any precision.

The numbers assigned to "perennial yield" in this report, presented and discussed in Chapter 4, are taken from Rush et al. (1971), as published by the Nevada State Division of Water Resources for Nevada, and a series of Water Resources and Hydrologic Reconnaissance reports published by the Utah State Department of Natural Resources for Utah. These published "perennial yield" estimates reflect water available from each hydrographic area viewed as a separate entity. Due to the methodology for deriving these estimates, the reader should be advised that where water flows between hydrographic areas, a multiple accounting of "perennial yields" may occur when viewed "additively" (F.E. Rush, 1980).

One problem with the definition set forth above is that its assigned value represents the percentage of the natural discharge that can be economically and safely captured. For many years water managers viewed natural groundwater discharge as "wasted" water because in most desert basins it is lost to evapotranspiration. If wells are strategically located in discharge areas, a portion or all of this "lost" water can be diverted to beneficial uses, and at the same time, the depletion of aquifer storage is minimized. In many areas of the Great Basin, however, areas of natural groundwater discharge support important wildlife and wetland habitats. These areas may provide habitats for endangered species, be of important cultural significance to Native Americans, and/or provide the basis for water-based recreation such as hunting and fishing. It makes little sense in such areas to plan groundwater development to capture groundwater discharge and avoid depletion of aquifer storage, especially if the amount of water available in storage is large.

Estimated volumes of economically recoverable water in aquifer storage in most valley fill aquifers exceed, by two or three orders of magnitude, the estimated perennial yields. Because the estimates of recoverable groundwater in storage in the Great Basin are so large, many hydrologists and water managers have questioned the orthodox interpretation of the appropriation doctrine which normally limits the assigned water rights for beneficial use to estimates of perennial yield.

In discussing issues relating to optimum development of groundwater in the Great Basin, Maxey (1968) states:

> "A growing consciousness of the tremendous volume of groundwater in storage, especially in relation to the relatively small volumes of water available from perennial yield, coupled with a growing awareness that pumping beyond the perennial yield does not necessarily imply catastrophic effects, has led many workers to question the validity of preserving water in storage at the expense of economic progress and expansion. In effect many are now asking how much withdrawal over perennial recharge may be optimum and have stopped considering seriously what the 'safe yield' may be."

Perennial yield was used as a gross resource characteristic in evaluating potential groundwater impacts resulting from M-X development in the Nevada/Utah deployment area (see Chapter 4 for further discussions). A compilation of perennial yield and aquifer storage, and estimate current use for each valley within the siting area is presented in Table 3.2.2.1-3.

Detailed descriptions of each of the hydrographic subunits are presented in ETR-12.

Surface Water Resources (3.2.2.1.2)

Surface water is scarce and its availability sporadic. In numerous documented discussions with local water users and state and federal agencies, it was concluded that existing surface water supplies were fully appropriated and that development of new reliable surface water supplies would be difficult if not impossible. It appears that utilization of surface water will be limited to purchase and/or lease from existing users and diversion from sources outside the siting area.

There are very few rivers within the M-X siting area or on the periphery. The largest and closest surface water source to the siting area is the Colorado River. Portions of the Colorado River Basin are contained within southeastern Nevada and the eastern half of Utah. The Colorado River originates from snow melt in the Rocky Mountains of Colorado, Wyoming and Utah. The two major surface water reservoirs on the Colorado, within Utah and Nevada, are Lake Powell and Lake Mead.

Waters of the Colorado River were included in the "Colorado River Compact", dated November 24, 1922. Various additional compacts, treaties, acts, and court decisions have refined and altered conditions since.

Rights to the majority of the Colorado River allocation in Nevada are held by the Las Vegas Valley Water District. Currently, the district has unused water available for temporary use. However, the current policy of the district is that long-term water use must be for municipal and industrial purposes, and is restricted to Clark County. Short-term use for agriculture or construction may be possible following a detailed study and review by district authorities. Legislative changes would be required for use outside of Clark County.

Aside from the Colorado River, there are a few other streams within close proximity to the siting area. Streamflow data for the major rivers in the area are

Table 3.2.2.1-3. Water availability for Nevada/Utah M-X affected valleys.

Hydrologic Subunit No.	Name	Perennial[1] Yield Acre-Ft X 10^3/Yr	Storage Per[1] Ft in First 100 Ft Acre-Ft X 10^3	Ground Water[2] Current Use Acre-Ft X 10^3/Yr	Ground Water[3] Availability Acre-Ft/Yr
4	Snake, Nev./Utah	49	120	15.8	33.2
5	Pine, Utah	7	12	M	7
6	White, Utah	32	7	M	32
7	Fish Springs Flat, Utah	35	6	M	35
8	Dugway, Utah	12	38	3.3	8.7
9	Government Creek, Utah	1	7	1.8	Mining[4]
46	Sevier Desert, Utah	25	82	49.2	Mining
46A	Sevier Desert-Dry Lake, Utah				
50	Milford, Utah	33	52	58.3	Mining
53	Beryl-Enterprise, Utah	30	45	78.5	Mining
54	Wah Wah, Utah	10	8	M	10
137A	Big Smoky, Nev.	6	70	30.4	Mining
139	Kobeh, Nev.	16	27	3.3	12.7
140A	Monitor-North, Nev.	8	10	M	8
141	Ralston, Nev.	6	27	1.0	5.0
142	Alkali Spring, Nev.	3	13	0.3	2.7
149	Stone Cabin, Nev.	2	22	1.0	1.0
151	Antelope, Nev.	4	12	0.4	3.6
154	Newark, Nev.	18	15	6.5	11.5
155A	Little Smoky-North, Nev.	5	15	M	5
155C	Little Smoky-South, Nev.	1	9	M	1
156	Hot Creek, Nev.	6	23	0.3	5.7
170	Penoyer, Nev.	5	22	5.7	Mining
171	Coal, Nev.	6	15	M	6
172	Garden, Nev.	6	15	0.1	5.9
173A	Railroad-South, Nev.	75	81	4.2	70.8
173B	Railroad-North, Nev.				
174	Jakes, Nev.	12	10	M	12
175	Long, Nev.	6	16	1.0	5.0
178B	Butte-South, Nev.	14	22	M	14
179	Steptoe, Nev.	70	50	12.5	57.5
180	Cave, Nev.	2	10	M	2
181	Dry Lake, Nev.	3	28	M	3
182	Delamar, Nev.	3	12	M	3
183	Lake, Nev.	12	18	14.2	Mining
184	Spring, Nev.	100	42	4.8	95.2
196	Hamlin, Nev./Utah	25	12	0.9	24.1
202	Patterson, Nev.	5	18	0.4	4.6
207	White River, Nev.	37	49	5.3	31.7
208	Pahroc, Nev.	2	13	M	2
209	Pahranagat, Nev.	25	17	2.9	22.1
210	Coyote Spring, Nev.	3, 18	18	M	3, 18

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[1] All Nevada numbers are from: Nevada, State of, 1971, Map: Water Resources and interbasin flows, Division of Water Resources, State Engineers Office, scale 1:750,000.
All Utah numbers are from: Price, Don, 1979, Summary appraisal of the water resources of the Great Basin in RMAG-UGA-1979 Basin and Range Symposium, p. 353-360.

[2] Groundwater use is defined as water pumped from wells. (M) Minor-less than 1,000 acre-feet/year, but not specifically estimated.
Unless otherwise noted, all Nevada figures are from: Industry Activity Inventory: Nevada MX siting area Desert Research Institute, University of Nevada system in Ertec, Inc. 1980, MX siting investigation, industry activity inventory.
Beryl-Enterprise and Milford estimates are from: Price, Don, and others, 1979, ground water conditions in Utah, spring of 1979: Utah Department of Natural Resources, Cooperative Investigation Report No. 18, p. 68.
Other Utah figure from: Industry Activity Inventory, Utah Water Research Lab, 1980. Butte, Jakes, and Long valleys were not inventoried as part of the industry activities study. However, the aggregate of wells inventoried in Butte and Jakes valleys during the valley reconnaissance program do not appear to have the combined capacity to produce over 1,000 acre-feet per year in either valley. Wells in Long Valley appear to have an aggregate capacity of about 1,000 acre-feet per year, but some wells were not in use at the time of field reconnaissance.

[3] Groundwater availability is defined here as potential additional groundwater diversion up to the perennial yield. Actual availability is determined by the State Engineer on case by case basis and appropriations have been granted in areas which already exceed perennial yield. A more appropriate estimate of availability would consist of the difference between the perennial yield and the sum of groundwater permits certificates and proofs as defined in Section 3.1.4.3. Since these water rights data are not fully available at the printing of this report, the given definition of groundwater availability is presented as the best estimate. Mining is defined as current ground water use exceeds perennial yield.

[4] Mining - Use exceeds estimated perennial yield, thus water is being removed from permanent groundwater storage.

shown in Table 3.2.2.1-4. The gauging stations shown are the furthest downstream for each river.

Streamflow in the region exhibits extreme variability. For the large perennial rivers variation in flow is associated with seasonal changes in precipitation and temperature. Melted water from snow in mountainous areas is the major source of water for those rivers. This is reflected in the extreme flow category in Table 3.2.2.1-4. For example, the maximum recorded flow (490 cfs) for Walker River occurred during the middle of April, 1978, the minimum flow (0 cfs) during July 1977 (USGS, Water Data Report NV-78-1). Streamflow in the area is also associated with extreme variations in weather. Heavy rainfall or cloudbursts will produce high flows; conversely, extended periods of drought will result in mimimum flows.

In addition to the large perennial streams, the area has thousands of ephemeral streams. These streams usually have short periods of very high rates of runoff, resulting from high-intensity storms or cloudbursts, separated by long periods of little or no flow. Due to their erratic runoff characteristics, existing uses of surface water in the ephemeral streams has been limited to impoundments in small stock and irrigation reservoirs.

The estimated total flow of a number of small streams in selected valleys in central Nevada is shown in Table 3.2.2.1-5. Table 3.2.2.1-6 shows actual flow characteristics for several streams. Average discharges range from 0.115 cfs to 8.85 cfs, and some streams have no water during the summer months.

Numerous springs are located within the siting area. These springs support streamflow and the larger ones may be used for irrigation. Generally, ditches are used to divert water for application in nearby fields. A portion of the spring flow is lost to evaporation and transpiration. A relatively small quantity of water used for irrigation seeps back into the ground and percolates to the groundwater reservoir.

Thermal mineralized springs are scattered throughout state, generally near faults. To date, geothermal energy resources have been used for heating houses, domestic water supplies, swimming pools and mineral baths, and the heating system of green houses.

The term 'wetlands' refers to those areas which are inundated by surface or groundwater with sufficient regularity to support vegetative or aquatic life that requires saturated soil conditions for growth and reproduction. Two of the major wetland areas are briefly described below:

- The bed of the pluvial White River, which is now dry for much of its course, has several wetland areas located in the Pahranagat and White River valleys. The wetlands in Pahranagat Valley are basically fed from Ash, Crystal, and Hiko springs. These thermal springs feed the Key Pittman Wildlife Management Area and upper and lower Pahranagat lakes.

- In Fish Springs Flat, Fish Springs National Wildlife Refuge contains three major and many minor springs. These springs have a combined flow of 45 cfs to 50 cfs (Bolen, 1964), and has an inundated area of three by six miles.

Table 3.2.2.1-4. Flow characteristics of major rivers in the Nevada/Utah study area.

River	Drainage Area (sq mi)	Years of Record	Period	Average Discharge (cfs)	Extremes Maximum (cfs)	Extremes Minimum (cfs)	Annual Discharge (Thousands Of Acre-Ft Per Year)
Utah[1]							
Bear River 10127110	7,075	7	1973-1978	2,163	6,900	240	1,567.0
Weber River 10143000	2,081	74	1966-1978	480	10,100	19	347.8
Jourdan River 10171000	3,438	35+	1943-1978	141	384	89	102.2
Sevier River 10224000	5,966	36+	1942-1979	186	2,980	3.9	134.8
Nevada[2]							
Muddy River 09419000	6,780	28+	1950-1978	45.5	7,380	7.6	32.9
Walker River 10301600	2,800	2	1977-1978	32.7	490	0	-
Carson River 10312280	1,9[illegible]0+	11	1967-1978	37.9	1,030	0	27.4
Humboldt River 10335000	16,100	35+	1899-1978	204	4,420	0	147.8
Truckee River 10351700	1,815	21	1957-1978	439	14,400	5.1	318.4

1500/10-6-81/F

[1]U.S. Geological Survey, 1977.
[2]U.S. Geological Survey, 1979.
[3]CFS = cubic feet per second.

Table 3.2.2.1-5. Estimated average annual flow of small streams in selected valleys in central Nevada.

Valley	Secondary Streams[1]		Minor Streams[2]	
	Number of Streams	Estimated Average Annual Flow (acre-ft/yr)	Number of Streams	Estimated Average Annual Flow (acre ft/yr)
Big Smoky	5	19,000	14	10,000
Butte	2	3,000	2	2,000
Little Smoky	1	3,000	-	-
Newark	2	4,000	2	2,000
Railroad	1	6,000	3	1,000
Ralston	-	-	3	2,000
Spring	11	40,000	10	10,000
Steptoe	6	35,000	5	5,000
Total	28	110,000	39	32,000

1501/9-20-81/F

[1] Annual flow for each stream is more than 1,000 acre-ft.

[2] Annual flow for each stream is less than 1,000 acre-ft.

Source: Pacific Southwest Inter-Agency Committee Water Resources Council, 1971.

Table 3.2.2.1-6. Flow characteristics of small streams in selected valleys in central Nevada.

Valley	Stream Name/ Station No.	Drainage Area		Average Discharge		Extremes Maximum		Extremes Minimum		Annual Discharge
		mi^2	(km^2)	cfs	(m^3)	cfs	(m^3)	cfs	(m^3)	(acre-ft)
Big Smoky	Kingston Creek/ 10249280	23.4	60.6	8.37	0.237	150	4.25	1.4	0.04	6,060
Little Smoky	Tributary Stream/ 10245800	157	407	0.115	0.0032	238	6.74	0	0	83
Railroad	Little Currant Creek/ 10246846	12.9	33.4	3.2	0.09	366	10.4	0	0	2,320
Steptoe	Steptoe Creek/ 10244950	11.1	28.7	8.85	0.25	37	1.05	2.0	0.06	4,990

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Source: USGS, 1977.

A playa is a geologic-landform feature and can be defined as a flat and generally barren lower portion of an arid basin with internal drainage that periodically floods and accumulates sediment. The most recognizable characteristics of playas are their essentially flat, smooth surfaces and their general lack of vegetation.

Because they occur at the lowest elevation, playas may become totally or partially flooded when excess precipitation or runoff occurs within a closed basin. Water in those shallow playa lakes is generally high in dissolved solids and suspended matter and is of poor quality. The high dissolved solid load is derived both from material transported in with the runoff water and from the redissolution of salts previously deposited on the playa surface. If the area is a true playa, the shallow lake will rapidly evaporate and deposit entrained salts and fine-grained sediments on the plays surface. It is obvious that such occasional flooding is an important factor in the development and maintenance of the very flat, smooth and barren playa surface.

Playas are very characteristic landform features of the Basin and Range Province. Within the State of Nevada, 115 major playas (herein defined as those greater than 0.25 sq mi in area) can be identified. Although they are a common feature of the Nevada landscape, relatively little is known about their surface or subsurface characteristics. Existing knowledge has been derived primarily from the sporadic mineral recovery operations conducted on several Nevada playas and, more recently, from broad-scale water resources investigations which considered the playas only as a part of overall surface or groundwater systems.

The term "floodplain" refers to any land area susceptible to being inundated from any source of flooding. Executive Order 11988 directs implementation of the "United National Program for Flood Plain Management" which recommends federal and state action to reduce the risk of flood losses through floodplain management. The base floodplain is an area subject to inundation from a flood with a one percent chance of occurring in any given year (100-year flood).

The Nevada/Utah study area presents problems in dealing with the traditional definitions and applications for floodplains. Defining a static floodplain for a certain magnitude flood is difficult, due to the nature of desert floods. Flood waters in the study area form a sheetlike action upon contact with the alluvium where the depth is very shallow (a few inches to several feet) and is spread out, covering a relatively large area. Since floods carry and deposit substantial amounts of debris, a subsequent occurrence will be redirected by those debris and result in a different area of inundation.

Detailed descriptions of the hydrologic condition of each valley are presented in ETR-12.

Water Law (3.2.2.1.3)

Water development and management is generally under state jurisdiction as there are no federal statutes governing water rights. The states impose regulations based on a combination of two basic doctrines: the appropriation rights, and the riparian right. Federal reserved rights will be discussed in this summary as well.

The Appropriation Right

Since 1845, the appropriation right was developed in the western states in response to the unique hydrologic character of that area. An appropriation is made when a person takes water from some source and applies it to some beneficial use. The ranking of rights is according to "first in time, first in right." That is, the earliest appropriation will be the last one required to curtail use if a shortage occurs.

Under this doctrine, the right to use water is independent of the ownership of land. Appropriation is limited to the amount reasonably needed for a beneficial use. Beneficial use is broadly defined and may include mining, manufacturing, agriculture, municipal, and culinary usage. The water right, under appropriation, can be traded or sold. It is also possible to lose the right through non-use or abandonment.

The Riparian Right

The riparian right is a water right attached to and inseparable from a parcel of land which is bounded by or traversed by a natural water course. By extension, riparian rights apply to groundwater lying beneath the land in question. A riparian proprietor has the right to the flow of the stream, undiminished in quality and quantity from a state of nature, except as affected by reasonable use by other proprietors. A riparian system typically has the following characteristics: a) rights to the use of water are created by ownership of land which is riparian to the water; b) the water right is a part of the ownership of the land and cannot be lost by non-use; and c) the riparian owner may use the water only on a riparian tract of land and may not sell it or use it himself off that tract.

Federal Reserved Rights

Federal reserved rights are based on two clauses of the Constitution: Article I, Section 8, "Congress shall have the power to regulate commerce with foreign nations, and among the several states, and with the Indian Tribes," and Article IV, Section 3, "The Congress shall have the power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States." These are, respectively, the Commerce clause and the Property clause of the Constitution. The Commerce clause is the source of federal water rights on navigable streams, and the Property clause is one of the sources of the federal water rights that is applied to Indian reservations and other land which has been reserved for some federal purpose, or otherwise withdrawn from public acquisition. The federal water right obtained under the property clause is inferior to the rights of state prior appropriators existing at the time that the federal reservation is made.

Overview of Nevada and Utah Water Laws

In both Nevada and Utah, the basic water law is the doctrine of prior appropriation for beneficial use.

In Nevada, the only requirement that must be satisfied for the appropriation of groundwater are: 1) unappropriated water available, 2) a recognized beneficial use, and 3) no interference with existing rights. The state engineer can be expected to

take into consideration lowering of water levels at nearby wells in determining availability, while considering the average annual replenishment rate.

In Utah, the state engineer shall approve an applicaltion for appropriation if 1) there is unappropriated water available, 2) the proposed use will not impair existing rights or interfere with a more beneficial use of the water, 3) the proposed use is physically and economically feasible, 4) the applicant has the ability to complete the plan, and 5) the application is filed in good faith and not for the purpose of speculation.

Statute law in both states gives the state engineers discretion in approving applications. Decisions of the state engineers can be appealed to the courts in both states.

Process for Obtaining Permits to Appropriate Water

Permits to appropriate water in Nevada and Utah require information on the applicant and enough information on the source of water, type of construction, and use to enable the state engineer to make an informed decision on approval of the appropriation. Required information includes name and address of applicant, source and amount of water, location and cost of works, purpose, and time frame for construction and use. Hydrologic information is not required but may be needed if a protest is filed. A more detailed presentation on Nevada and Utah can be found in Appendix D of ETR-12. Also found in ETR-12 is a presentation of the water rights within the basing area.

Water Resources Program (3.2.2.1.4)

The following material is included to provide the reader with a description of M-X water resource investigations currently underway, and those planned for the future. Unfortunately the basic data and interpretative results from the majority of this work were not available at the time this document was prepared. The results that were available are presented primarily in Section 3.1.3 and 3.1.4 of ETR-12. The data and findings of the additional studies will be presented and discussed in future documents produced as part of the analyses for subsequent decisionmaking.

The M-X Water Resources Program was initiated in June 1979 for the purpose of evaluating the availability of water for both the construction and operational phases of the M-X project in Nevada and Utah.

The primary objectives of the overall Water Resources Program are to:

- o Determine the effects of M-X groundwater withdrawals on the local water users, the environment, and the aquifers.
- o Determine the optimum water source and supply system, with possible supply alternatives for each valley.
- o Provide the necessary data and documentation in support of the conclusions and recommendations of the Water Resources Program. The regulatory agencies will require thorough documentation prior to granting permits and permission for water development and use.

The scope of the Water Resources Program includes the following:

- Review of pertinent publications and data contained in agency files relating to water availability, local water use, regional groundwater flow systems, and aquifer characteristics.

- Obtain information from various state and federal officials knowledgeable about groundwater conditions in Nevada and Utah.

- Determination of the amount of water required for construction and operation of the M-X system.

- Hydrogeologic field studies to identify water users, measure groundwater levels, collect groundwater samples for chemical analyses, measure spring and well discharges, conduct aquifer tests, and overview general hydrogeologic conditions.

- Drilling and testing of shallow (about 500 ft) and intermediate (about 1,000 ft) valleyfill wells and deep carbonate rock (about 2,500 ft) wells. This work is in progress.

- Assess municipal water supplies and wastewater treatment facilities for their capacity to handle increases due to M-X population influx. This study included towns within, and immediately adjacent to, the siting area with emphasis on Tonopah, Ely, Caliente, and Pioche in Nevada, and Delta, Milford, and Cedar City in Utah.

- Evaluate basin structure to better understand regional groundwater flow systems.

- Compute numerical modeling simulations of the groundwater system in selected valleys to assess the effects of M-X groundwater withdrawals on local water users and the environment.

- Inventory industry activity to identify the water requirements of existing and proposed industries in the siting area and how these requirements may interact with M-X construction and operational activities. This study was conducted by the Desert Research Institute for Nevada and the Utah Water Research Laboratory for Utah.

- Study Nevada and Utah water laws and permitting procedures, and inventory water rights. This study was conducted by the Desert Research Institute for both Nevada and Utah.

As part of the Water Resources Program more than 50 wells have been drilled in the valley-fill and carbonate aquifers, over 45 aquifer (pump) tests have been performed, more than 300 water-quality analyses have been completed, and over [illegible] water-level and discharge measurements have been made. The findings of the Water Resources Program to date have been presented to the Air Force [illegible] Office in a series of technical reports. The reports and their general [illegible] listed below:

- "M-X Siting Investigation, Geotechnical Summary, Water Resources Program FY 79," 21 December 1979. This report included the preliminary results of the field investigation of Big Smoky, White River, Dry Lake, Snake, Hamlin, and Tule valleys during FY 79. The eport presented potentiometric level maps and water quality data, along with discussions of the hydrologic conditions in the valleys.

- "M-X Siting Investigation, Water Resources Program, Summary for Draft Environmental Impact Statement," 15 May 1980, revised 1 August 1980. This report summarized the results of the investigation of 16 valleys in the siting area, including an update of the six previously reported valleys. The valleys included the six mentioned above plus: Cave Valley, Delamar Valley, Dugway Valley, Fish Springs Flat, Little Smoky Valley, Pine Valley, Railroad Valley, Sevier Desert, Wah Wah Valley, and Whirlwind Valley. The report included a description of the general hydrology, details of the aquifer characteristics, and the water quality limitation of the subject valleys. The report discussed potential impacts of M-X groundwater withdrawals and mitigating measures. The report also included a listing of all discharge measurements, water quality determinations, aquifer test data, and water level measurements, as well as potentiometric level drawings.

- "Overview of Nevada and Utah Water Law: Historical Development and Current Procedures for Rights Acquisition," revised 2 June 1980. This report provided baseline information for, and a description of, the process for obtaining water rights with background on water law of Nevada and Utah. This report has served as a basic guideline for M-X groundwater appropriation applications.

- "Municipal Water-Supply and Wastewater-Treatment Facilities in Selected Nevada and Utah Communities," dated 20 June 1980 (this report was also submitted to the Air Force as Volume III of the summary report for the Draft Environmental Impact Statement, 15 May 1980). This study was an assessment of the municipalities and towns within and adjacent to the M-X siting area and their capacity for increasing their water supply and wastewater treatment facilities.

- "M-X Siting Investigation, Water Resources Program, Industry Activity Inventory, Nevada/Utah," 2 September 1980. This report provided an assessment of current water use and projected future use by industry and other users.

- "M-X Siting Investigation, Water Resources Program, Interim Report," 31 October 1980. The Interim Repoert was an extension of the technical summary report series and included the preliminary results of the investigation of the following valleys: Big Sand Springs, Coal, Garden, Lake, Muleshoe, Pahroc, Penoyer, and Spring. The information presented in the report is similar to that of the Summary of Draft Environmental Impact Statement.

- "M-X Siting Investigation, Water Rights Inventory, Nevada/Utah, Water Resources Program FY 80," 19 December 1980. This report presents a

summary of surface and groundwater rights in the siting area, with a breakdown according to applications, permits, certificates and proofs.

- "M-X Siting Investigations, Water Resources Program, Progress Report," 13 February 1981. The Progress Report presents the status of Water Resources Program activities, since the Interim Report of 31 October 1980, through 9 January 1981. It also discusses the preliminary results of field drilling, testing and reconnaissance programs, OB studies, and computer numerical model simulations of valley-fill aquifers in selected valleys.

- "M-X Siting Investigation, Water Resources Program, Operational Base Studies Report, Volume I, Coyote Springs Operational Base, Nevada," 28 May, 1981. This report presents a comprehensive discussion of the water resources of the Coyote Springs Valley area with supporting data.

- "M-X Siting Investigation, Water Resources Program, Operational Base Studies Report, Volume II, Milford and Beryl Operational Bases, Escalante Valley, Utah," 28 May 1981. This report has a similar format and content to the Coyote Springs OB report.

- "M-X Siting Investigation, Water Resources Program, Technical Summary," (in publication). This report presents a comprehensive overview of the water resources of the siting area, with discussion of the preliminary results of the carbonate aquifer program and specific supporting discussion of the hydrologic conditions in each deployment area valley.

Erosion (3.2.2.2)

Soils in the Nevada/Utah DDA can be generalized into four landscape situations: Playas; valley floors, and floodplains; piedmont slopes; and mountains. A more detailed breakdown is inappropriate due to insufficient data base. Areas where more detailed information is available are discussed in ETRs-11 and 34.

1. Soils formed on the flat playa beds areas are the result of repeated flooding and evaporation. When groundwater is near the surface, playa soils may be soft and "puffy". Often, however, the playa surface is smooth and crusted. Playa soils can be expected to be high in fine materials that have been transported from surrounding areas while coarser sediments have been retained on alluvial fans. Additionally, most playa beds are high in salts due to the repeated flooding and evaporation. Undisturbed playa sediments can be quite resistent to wind erosion because crusting occurs after drying and few sands are present. However, if pulverization of the crust occurs such as from vehicles, the fine materials could be readily transported, primarily in suspension. Playa soils are not especially susceptible to water erosion due to their nearly flat slopes and high clay content.

2. Soils that have formed on valley floors and floodplains are generally higher in sand than are playa soils, but also contain considerable quantities of finer

material. These soils are slightly to moderately susceptible to wind erosion and low in susceptibility to water erosion.

3. Piedmont slopes (transition slopes between mountains and valley floors) occupy much of the landscape. Soil textures vary considerably. In general, coarse soil particles such as gravel increase upslope toward the adjoining mountains. Cemented layers occur in many of these soils. Susceptibility of piedmont slope soils to wind erosion ranges from extremely erodible to moderately erodible. Water erodibility of these soils ranges from low to moderate. The presence of gravels on upper fan soils greatly reduces their susceptibility to wind erosion by increasing surface roughness.

4. Mountain soils have formed under quite different climatic and vegetative regimes than the soils discussed above. Somewhat higher precipitation, cooler temperatures, and denser vegetation have resulted in an environment that is generally less conducive to wind and water erosion. However, water erosion can be a problem on steep slopes.

Air Quality (3.2.2.3)

Meteorology

The Nevada/Utah basing area includes numerous mountain ranges and a well defined ridge and valley system. In general, the most significant climate features of the region are considerable sunshine, low relative humidity, extreme daily ranges of temperature, and variable precipitation patterns with very little precipitation in the valleys and more at higher elevations. Despite the general lack of meteorological data in the basing region, the typical dispersion climatology can be approximated by examining data from nearby weather stations in Nevada and Utah. The dispersive capability of the atmosphere in this region is good as indicated by relatively high average mixing heights and wind speeds (Table 3.2.2.3-1). However, the frequent occurrence of surface-based inversions produced by nocturnal radiational cooling and cold air drainage into the valleys can minimize dispersion during the morning hours. Additionally, persistent Great Basin high pressure systems over the region produce subsidence inversions which can effectively "cap" the valleys and prevent the flux of pollutants out of them. The prevailing upper air winds in Nevada/Utah are from the west and southwest. However, the mountain and valley topography strongly influences local wind speed and direction. Because of the predominant north-south orientation of the mountain ranges, the surface wind direction also tends to be from the north and south.

Air Quality

The federal, Nevada, and Utah ambient air quality standards are presented in Table 3.2.2.3-2. Sulfur dioxide standards have been violated in the Steptoe Valley, mainly due to the copper smelter at McGill (Figure 3.2.2.3-1). Ambient monitoring data in other portions of the study area are not sufficient to determine whether any other standards have been violated.

Only one Mandatory Class I Air Quality Area (minimal degradation permitted), Jarbidge National Wilderness Area, has been identified in Nevada and one area,

Table 3.2.2.3-1. Mixing heights and wind speeds for stations in Nevada/Utah.

Station	Time	Winter		Spring		Summer		Autumn		Annual	
		HT[1]	U[2]	HT	U	HT	U	HT	U	HT	U
Ely, NV	Morning	193	5.1	489	5.1	109	4.2	161	4.5	238	4.7
	Afternoon	1,072	5.5	2,708	7.4	3,624	7.0	2,179	6.1	2,396	6.5
Las Vegas, NV	Morning	321	4.5	433	5.6	292	4.7	276	4.3	331	4.8
	Afternoon	1,153	4.2	2,785	7.1	3,693	6.7	2,106	5.2	2,434	5.8
Winnemucca, NV	Morning	301	3.3	434	4.1	129	2.7	255	3.4	280	3.4
	Afternoon	1,067	4.9	2,756	6.8	3,656	6.2	2,150	5.4	2,407	5.8
Salt Lake City, UT	Morning	329	4.3	419	5.4	216	4.6	238	4.6	300	4.7
	Afternoon	944	4.6	2,675	6.6	3,737	6.2	1,933	5.5	2,322	5.7

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[1] Mixing height given in meters.

[2] Wind speeds are averaged through the mixed layer and are in units of meters per second.

Source: Holzworth, G.C. 1972. "Mixing heights, wind speeds, and potential for urban air pollution throughout the contiguous United States," USEPA, Office of Air Programs, RTPNC, January.

Table 3.2.2.3-2. Summary of National Ambient Air Quality Standards (NAAQS) and Nevada and Utah[a] ambient air quality standards.

Pollutant	Averaging Time	NAAQS and Utah Standards Primary	NAAQS and Utah Standards Secondary	Nevada Standards Primary
Carbon Monoxide	8-hour[b]	10 mg/m^3 (9 ppm)	Same as primary standards	Same NAAQS
	1-hour[b]	40 mg/m^3 (35 ppm)		Same as NAAQS
Carbon Monoxide above 5000 feet MSL	8-hour[b]	10 mg/m^3 (9 ppm)		6.67 mg/m^3 (6.0 ppm)
	1-hour[b]	40 mg/m^3 (35 ppm)NAAQS		Same
Ozone	1-hour[c]	235 ug/m^3 (0.12 ppm)	Same as primary standards	Same as NAAQS
Ozone (Lake Tahoe Basin)	1-hour[c]	Not Applicable	Not applicable	195 ug/m^3 (0.10 ppm)
Nitrogen Oxide	Annual (Arithmetic Mean)	100 ug/m^3 (0.05 ppm)	Same as primary standard	Same as NAAQS
Hydrocarbons (corrected for methane)	3-hour (6-9 a,m,)	160 ug/m^3 (0.24 ppm)	Same as primary standard	Same as NAAQS
Sulfer dioxide	Annual (Arithmetic Mean)	80 ug/m^3 (0.03 ppm)	Same as primary standard	Same as NAAQS
	24-hour[b]	365 ug/m^3 (0.14 ppm)		Same as NAAQS
	3-hour[b]	None	1,300 mg/m^3 (0.5 ppm)	1,300 ug/m^3 (0.5 ppm)
Total Suspended Particulate Matter	Annual (Geometric Mean)	75 ug/m^3	60ug/m^3[d]	75 ug/m^3
	24-hour[b]	260 ug/m^3	150 ug/m^3	260 ug/m^3
Lead	Quarterly (Arithmetic Mean)	1.5 ug/m^3	Same as primary standard	Same as NAAQS

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[a]All Utah standards are equivalent to NAAQS.

[b]Not to be exceeded more than once per year.

[c]The ozone standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one.

[d]Secondary annual TSP standard (60 ug/m^3) is a guide for assessing State Implementation Plans.

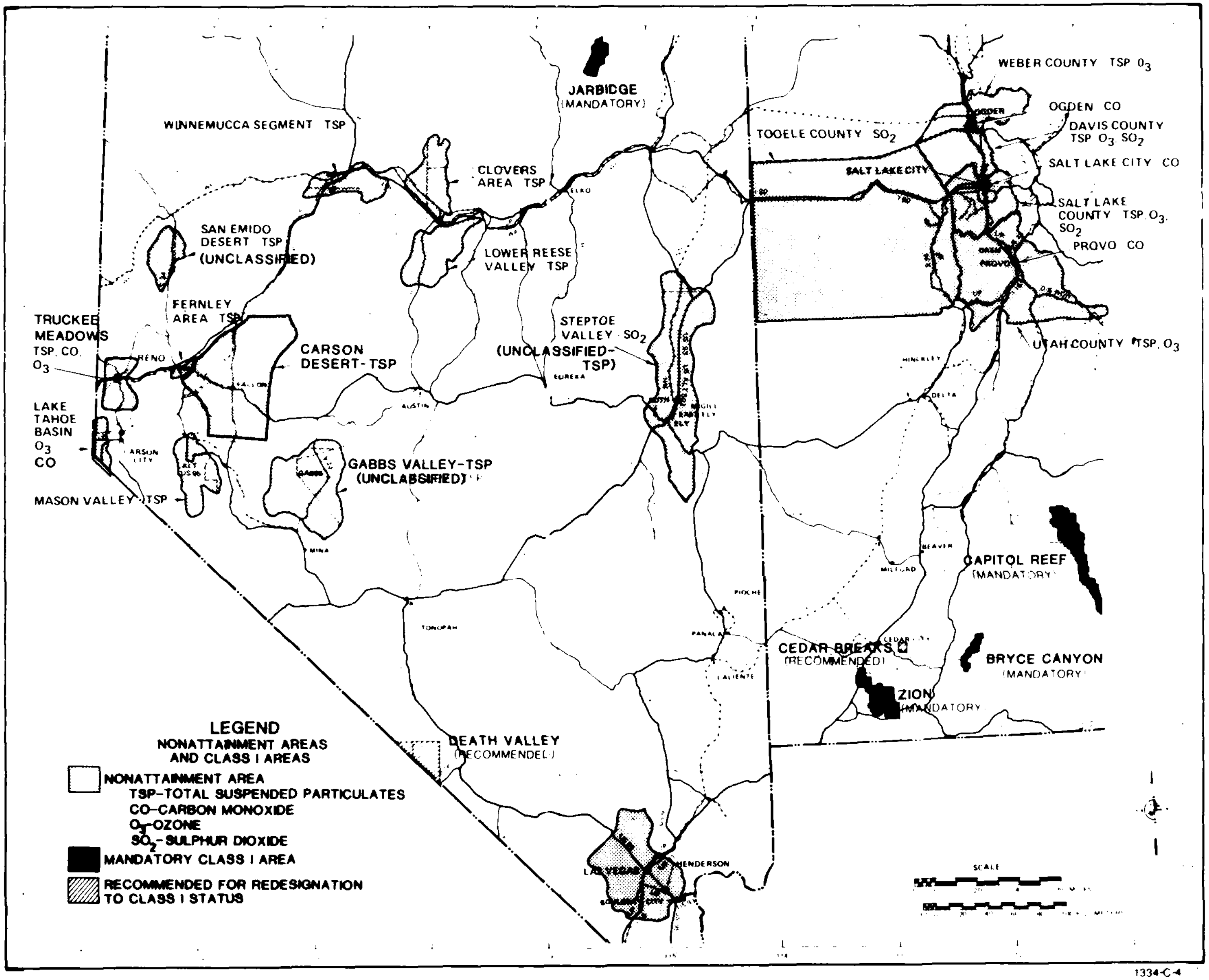

Figure 3.2.2.3-1. Nonattainment areas, mandatory Class I areas, and areas recommended for redesignation to Class I status in the Nevada/Utah study area.

Death Valley, has been recommended for redesignation to Class I status. In Utah, there are three Class I areas: Capitol Reef, Zion, and Bryce Canyon National Parks. There is one area recommended for consideration for redesignation to Class I status, the Cedar Breaks National Monument in Utah (Figure 3.2.2.3-1). Great Basin National Park has also been proposed. However, its designation as a national park would not afford it Class I status automatically.

Mining and Geology (3.2.2.4)

A complete discussion of the geology and mining industry of the deployment area is presented in ETR-11. A brief summary of the major issues is presented here.

The Nevada/Utah deployment area is made up of mountain ranges of mainly Paleozoic sedimentary, or Cenozoic volcanic bedrock separated by alluvium-filled valleys. The ranges and valleys are bounded by steeply dipping faults, many of which show evidence of geologically recent (less than one million years) activity. The uplifted mountain ranges contain most of the known sites of mineralization. Mineralization may extend beneath the valleys. The down-dropped valleys contain alluvial fill to thicknesses up to 10,000 ft.

Seismicity (3.2.2.4.1)

Between 1934 and 1960, Nevada was one of the most seismically active area in the western United States (Slemmons, 1965; Wallace, 1977). During the period between 1952-1960, 1,173 earthquakes were recorded in Nevada and 586 of those were of a magnitude greater than 4 (Slemmons, 1965). Nevada seismic activity has been concentrated in the Ventura-Winnemucca zone.

In Utah, between 1850 to 1962 413 earthquakes were recorded; 99 were of a magnitude greater than 4 (Arabasz et al., 1979). This activity is concentrated along the Intermountain Seismic Belt (ISB) (Cook, 1967; Smith and Sbar, 1974). Ninety percent of the earthquakes in Utah occurred in areas where fault zones are recognized (Cook, 1972).

Ventura-Winnemucca Seismic Zone

The west-central portion of the Great Basin is transected by a 600-km-long seismic belt that extends from Ventura, California north-northeastward to Winnemucca, Nevada. The Ventura-Winnemucca zone historically has been one of the most active seismic zones in the United States during its peak activity.

Although this zone includes a line of historic faulting, there is generally poor correlation of epicenters with known structural elements (Ryall et al., 1966).

The Intermountain Seismic Belt

The Intermountain Seismic Belt (ISB) is also one of the most active seismic zones in the United States (Smith and Sbar, 1974). The ISB is a 1300-km-long 100-km-wide belt extending from Nevada and Arizona northward into Montana, and it coincides with the boundary between the Basin and Range and the Colorado Plateau provinces (Smith and Sbar, 1974; Walper, 1976; Wechsler and Smith, 1978)

Seismicity along this zone is shallow; earthquake hypocenters are generally less than 20 km deep (Sbar, 1972). Fault motion in the Utah segment of the ISB is generally along steeply dipping (or vertical) fault planes (Sbar et al., 1972). The ISB coincides with several major fault zones, the largest of which are the Wasatch Front, the Hurricane, Sevier, and Cache fault zones. The intensity of youthful activity along the ISB in Utah is demonstrated by the large amount of total vertical displacement (3.5 km; Smith and Sbar, 1974) and by the large number of earthquakes that have been recorded along the zone.

The Wasatch Front comprises a large fault scarp along the western boundary of the Wasatch Mountains; evidence of Holocene normal faulting is present over much of the length of the scarp (Sbar et al., 1972; U.G.M.S., 1976). An unusual aspect of this fault is that, although it shows evidence of a great amount of past movement, the present-day seismic activity is quite low (Sbar, 1972). Although there has been no historic surface ruptures on the Wasatch Fault, there is evidence of repeated moderate to large magnitude earthquakes ($M = 6.5 - 7.5$) during late Pleistocene and Holocene time (Swan et al., 1980). Most of this evidence is in the form of fresh scarps which displace Lake Bonneville shoreline deposits, alluvial fans, and glacial moraines (Hamblin, 1976).

<u>Minerals</u> (3.2.2.4.2)

Known metallic mineral deposits are found primarily in the mountain ranges (Figure 3.2.2.4-1). It is highly likely that mineralization also occurs under the valley alluvium. With present technology, it would be possible to find and develop only those deposits under shallow alluvial cover along the edges of the valleys. The most likely occurrences are extensions of known deposits in the mountains or along mineral bands or belts. Non-metallic minerals are found in certain playa deposits in the Great Basin, and sand and gravel deposits are concentrated along the mountain fronts.

Conditions in the Great Basin are suitable to the formation of zeolite deposits. There are at least 33 known and possibly commercial zeolite deposits distributed around Nevada (Papke, 1972). Only one of these deposits, Jersey Valley erionite in the northern end of Jersey Valley in Pershing County, has had significant past production. One potentially commercial deposit of zeolites has been reported in the Great Basin of Utah, near Cove Fort. Zeolites are discussed in more detail in Chapter 9 of ETR-11 and the ETR on Public Health Issues.

Minerals - Nevada

The value of Nevada's mineral output, including petroleum, rose to $369.4 million in 1980, an increase of 55 percent from that of 1979. The increased value was primarily a result of increased gold production and price escalation. Twenty-six mineral commodities were produced in the state--9 metals, 16 nonmetallic materials, and mineral fuel. Metals accounted for 45 percent of total production value, and nonmetallics for 55 percent. Most of the mineral production came from the northern three-quarters of the state, with the southern quarter producing most of the non-metallics (gypsum, limestone, and clays).

In 1978, for the first time in more than 50 years, gold replaced copper as the state's leading mineral commodity, followed by sand and gravel in second place, and

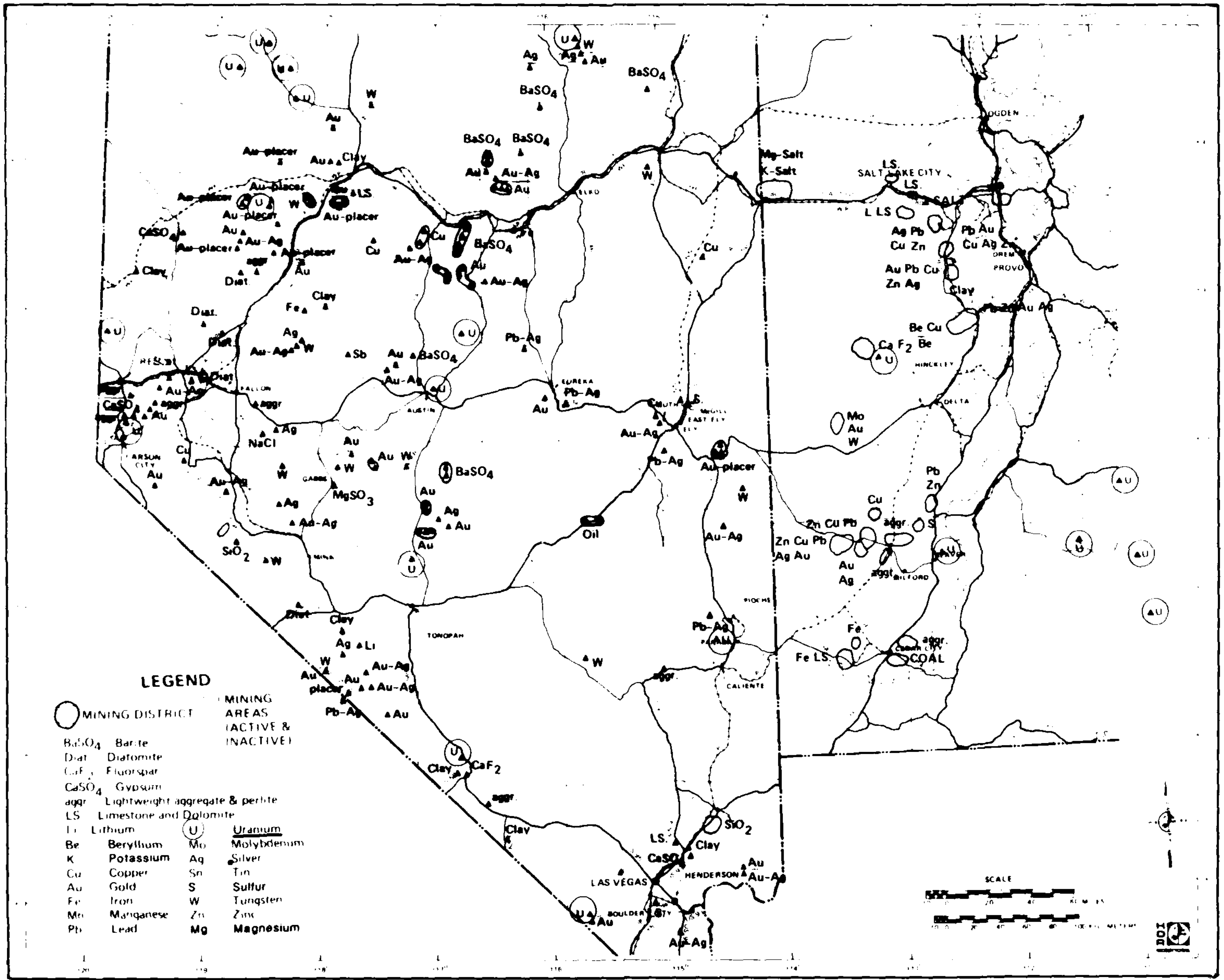

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Figure 3.2.2.4-1. Occurrence of mineral deposits within and near the Nevada/Utah study area.

barite in fourth. Nevada ranked first in the nation in production value of barite, magnesite, and mercury; and second in gold. The state's copper industry from the early 1930s to the late 1970s accounted for about three-fourths of total minerals ouput, but in 1978 the three top producers shut down, citing poor copper market conditions and environmental restrictions as the reasons for their closures. Nevada's largest zinc producer also closed during the same year owing to depressed market conditions. Table 3.1.1-1 in ETR-11 summarizes the state's mineral production from 1970 to 1980. The decline of copper from its preeminent rank is clearly indicated.

Nevada ranks second in United States gold output, accounting for about 27 percent of domestic production. Carlin Gold Mining Company, a wholly owned subsidiary of Newmont Mining, operates an open-pit gold mine near Carlin, Elko County. Carlin is the second largest gold mine in the United States, and produces about 80 percent of Nevada's gold. The remainder comes from small-scale mining operations and is a by-product of other metallic mining in the state. Several new gold mines are being developed and they will make Nevada the number one gold producing state. Two new silver mines will substantially increase the Nevada silver production. Molybdenum is an increasing commodity in Nevada with several new mines in the developmental stage.

The overall M-X proposed deployment area in Nevada overlaps a substantial segment of the state's minerals industry. These six counties - Esmeralda, Eureka, Lander, Lincoln, Nye, and White Pine - accounted for 58 plus percent of the total state minerals output in the late 1970s (see Table 3.2.2.4-1). Output by mineral commodity in the six-county area is also shown. Copper, gold, and barite are the minerals of major economic value.

Public comments expressed concern that the DEIS did not adequately assess the viability and quality of concrete and road-base aggregates in the M-X deployment area or the impacts that M-X utilization at available sources will have on local industry. However, aggregate studies conducted for this project indicate plentiful resources of stone, sand, and gravel are available for construction purposes. Refer to ETR-31, Construction Resources.

Minerals - Utah

Historically, Utah's metallic mineral resources have been the major components of the state's minerals industry. In 1980 production of copper, gold, and silver was valued at $502 million, and accounted for almost 66 percent of the total value of Utah's non-fuel mineral production (Table 3.2.2.4-2). In contrast to Nevada, most of Utah's mineral production occurs outside of the M-X proposed deployment area.

The production of copper exceeded that of all other metals, and in 1980 accounted for 46 percent of the state's total mineral production value. According to the U.S. Bureau of Mines, approximately 3 percent of the world's and 14 percent of the nation's new copper is produced annually by Utah.

Utah is the largest producer of beryllium ore in the United States. It ranks in the top four in the production of gold, silver, lead, and molybdenum. Utah is also an important producer of zinc and iron.

Deposits of nonmetallic and industrial minerals widely distributed throughout the state, with sand and gravel, are among Utah's most valuable nonmetallic

Table 3.2.2.4-1. Gross yield of mines and minerals produced in Nevada study area counties (1977).

County	\$000[1]	Percent of Total (State)	Minerals Produced in 1976 in Order of Value
Esmeralda	N.A.	N.A.	mercury, diatomite
Eureka	29,681	15.5	gold, iron ore, stone, mercury
Lander	27,728	14.5	copper, gold, barite, silver, lead, zinc
Lincoln	5,350	2.8	stone, sand and gravel, perlite, zinc
Nye	21,595	11.3	magnesite, petroleum, fluorspar, sand gravel, molybdenum, gold
White Pine	26,536	13.8	copper, gold, lime, silver
Study Area Total	110,890	57.8	

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[1]State total is \$191,605,000.

Sources: University of Nevada, Bureau of Business Economic Research, Nevada Review of Business and Economics (Summer, 1978),p.21 adapted; Bureau of Mines, Minerals Yearbook, 1976, (reprint), p.3.

N. A. Not Available.

Mining is the major source of income in White Pine County, Nevada where copper, gold, lime and silver have historically been produced. This operation is just west of Ely.

Table 3.2.2.4-2. Mineral production and value in Utah study area counties (1975).

County	Value $000	Value Percentage of State	Minerals Produced, In Order of Value
Beaver	176	Negligible	Sand and gravel
Iron (1974)	14,727	1.5	Iron ore, sand and gravel
Juab	627	Negligible	Fluorspar, clays, gypsum, sand and gravel
Millard	*	Negligible	Gypsum, stone, pumice, beryllium, sand and gravel
Tooele	12,100	1.3	Potassium salts, salt, lime, sand and gravel
Study Area Total	27,640+	2.9	
Utah Total	966,497	100.0	

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*Withheld to avoid disclosing individual company confidential data.

Source: U.S. Bureau of Mines, Minerals Yearbook 1975: Volume II Area Reports, Domestic, p. 749.

minerals. Salt and gypsum are other major nonmetallic mineral products. Although most nonmetals produced are used to supply local market demands, the state exports potash, salt, gypsum, and magnesium chloride.

Vegetation and Soils (3.2.2.5)

A simplified vegetation type map for the Nevada/Utah area is shown in Figure 3.2.2.5-1. The valleys in the study area are dominated by Great Basin sagebrush, shadscale scrub, alkali sink scrub, and pinyon-juniper woodland (Figure 3.2.2.5-2). Mountain ranges separating the valleys are covered by pinyon-juniper woodland at lower elevations, with brushlands and sparse coniferous forests at higher elevations. The southern part of the study area is transitional between the Great Basin and hot desert floristic provinces and is dominated by creosote bush scrub with some Joshua tree woodland. Major vegetation types of the valleys and lower mountain slopes of the study area are summarized in Table 3.2.2.5-1, and presented in greater detail in ETR-14, "Native Vegetation."

Some vegetative features are not widespread, nor are they rare or threatened with extinction. However, these features are atypical, unusual or unique in the area. Examples of such unique vegetation include: range extensions, relict populations, unusual ecotypes, hybridization zones, aquatic or wetland vegetation, bald mountains, Joshua-tree zones, alpine or sub-alpine vegetation, and sand dune vegetation. These unique vegetation types are discussed in greater detail in ETR-14, Sections 1 and 2. Also included in these sections is a discussion of timber resources.

The major disturbance to vegetation--grazing by cattle, wild horses, and burros--has changed the composition of plant species, with shrubs increasing over grasses. Areas of crested wheatgrass have been planted to improve grazing range in the northern and central portions of the study area. After disturbance, vegetation is very slow to recover, taking from decades to centuries. A detailed discussion of fragile desert ecosystems is presented in ETR-14, "Native Vegetation."

The Nevada/Utah study area is made up of a series of valleys typically consisting of the following physiographic features and their characteristic soil types: (1) playas, (2) valley bottoms and floodplains, (3) alluvial fans and stream and lake terraces, and (4) uplands and mountains (Figure 3.2.2.5-3).

1. Playas consist of light-colored clayey deposits with very strong accumulations of salt. Any free water from melting snow and summer thunderstorms usually ponds on the surface with salt crusting sometimes occurring during dry periods. Playas are mostly devoid of vegetation, and subject to severe wind erosion when their surface is disturbed.

2. Valley bottoms and floodplains have smooth to gently undulating slopes with deep, alkaline soils. Their surface textures range from loams to silty clay loams, while the subsoils range from fine loams to fine silts. Permeability ranges from very slow to moderately rapid, and wind erosion of the disturbed soil is moderate.

3. Alluvial fans and streams and lake terraces comprise the largest areas in the valleys. The soils vary in depth and are alkaline. Their surface texture ranges from fine sands to gravelly sandy loams to silty clay

VEGETATION TYPES

LEGEND

WESTERN FORESTS

DOUGLAS FIR FOREST
(*Pseudotsuga*)

WESTERN SPRUCE-FIR FOREST
(*Picea-Abies*)

PINE-DOUGLAS FIR FOREST
(*Pinus-Pseudotsuga*)

ARIZONA PINE FOREST
(*Pinus*)

SPRUCE-FIR-DOUGLAS FIR FOREST
(*Picea-Abies-Pseudotsuga*)

GREAT BASIN PINE FOREST
(*Pinus*)

JUNIPER-PINYON WOODLAND
(*Juniperus-Pinus*)

JUNIPER STEPPE WOODLAND
(*Juniperus-Artemisia-Agropyron*)

WESTERN SHRUB AND GRASSLAND

MOUNTAIN MAHOGANY-OAK SCRUB
(*Cercocarpus-Quercus*)

GREAT BASIN SAGEBRUSH
(*Artemisia*)

BLACKBRUSH
(*Coleogyne*)

SALTBUSH-GREASEWOOD
(*Atriplex-Sarcobatus*)

CREOSOTE BUSH
(*Larrea*)

DESERT: VEGETATION
LARGELY ABSENT

■ *Yucca brevifolia* (JOSHUA TREE)

▼ *Juniperus spp.* (JUNIPER, RED CEDAR)

TULE MARSHES
(*Scirpus-Typha*)

WHEATGRASS-BLUEGRASS
(*Agropyron-Poa*)

ALPINE MEADOWS AND BARREN
(*Agrostis, Carex, Festuca, Poa*)

SAGEBRUSH STEPPE
(*Artemisia-Agropyron*)

GALLETA-THREE AWN SHRUBSTEPPE
(*Hilaria-Aristida*)

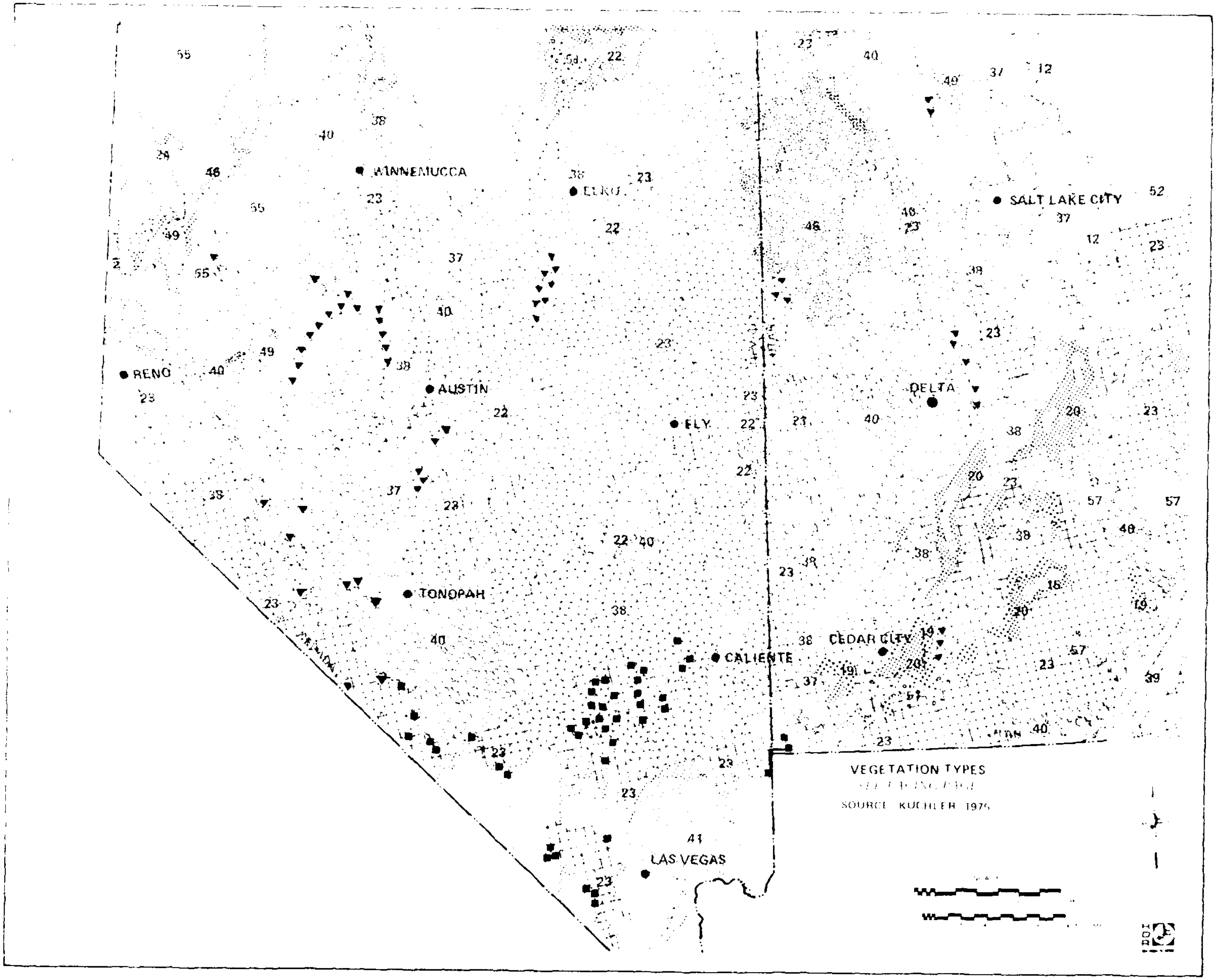

Figure 3.2.2.5-1. Simplified vegetation type map for the Nevada/Utah study area.

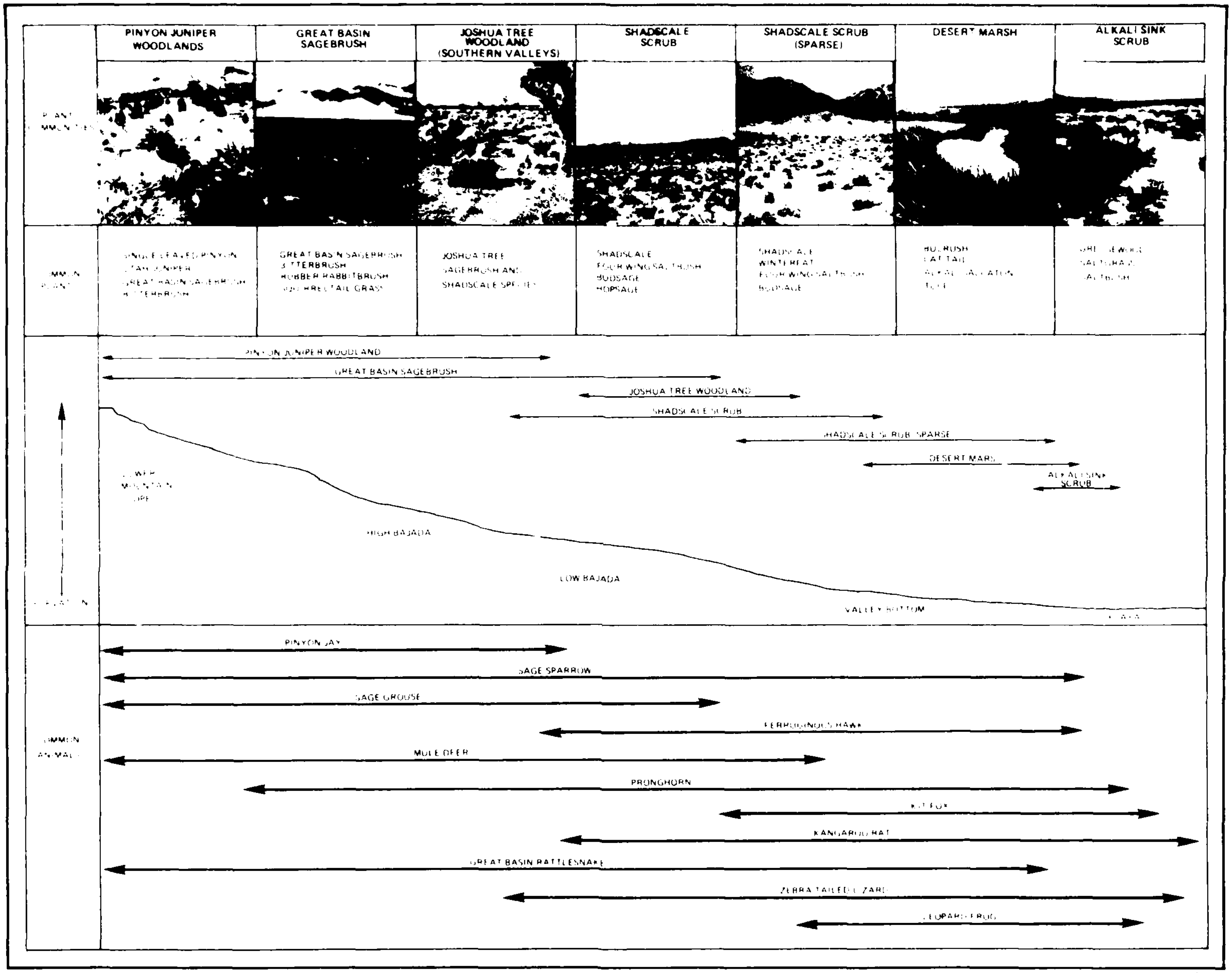

Figure 3.2.2.5-2. Plant and animal relationships along an elevational gradient in the Nevada/Utah study area.

Table 3.2.2.5-1. Major vegetation types in the Nevada/Utah study area (Page 1 of 2).

Type	General Location	Composition	Sources of Present Disturbance
Alkali Sink Scrub	Low elevations, valley bottoms, playa margins; in saline or alkaline clay soils; Nevada and Utah	Shrubs 1 meter tall or less and low herbs	Grazing; off-road vehicles
Creosote Bush Scrub	Dry areas of low topographic relief; southern Nevada and southwestern Utah	Shrubs dominate, with perennial herbs, grasses, and annuals	Off-road vehicles
Wash and Arroyo Vegetation	Low elevations, dry stream courses and major drainage channels; southern Nevada	Medium-sized to large shrubs, perennial and annual herbs and grasses	Flash floods, cattle grazing
Desert Marsh and Spring Vegetation	Low elevations where the water table lies near the ground surface; scattered throughout Nevada and Utah	Small trees, shrubs, perennial herbs and grasses; species vary according to salinity of soil and water	Damming and impounding of water for livestock, trampling by livestock, and pollution and sedimentation from recreation and other uses

Table 3.2.2.5-1. Major vegetation types in the Nevada/Utah study area (Page 2 of 2).

Type	General Location	Composition	Sources of Present Disturbance
Riparian (Streambank) Woodland	Along banks of perennial and some intermittent streams	Varying densities of mesophytic deciduous trees	Trampling by livestock, pollution and sedimentation from recreation and other uses
Shadscale Scrub	Valley bottoms or rocky slopes; Nevada and southwestern Utah	Low shrubs, perennial herbs and grasses	Grazing, erosion, off-road vehicles
Great Basin Sagebrush	Rocky mountainsides, broad valleys, and low foothills; in deep, permeable, nonsaline soils; central and northern Nevada/Utah	Dense shrubs and bunchgrasses	Overgrazing, disking, and defoliant. Spraying development of strip mining and urban areas, off-road vehicles, and other recreation uses
Pinyon-Juniper Woodland	Mountainous terrain and high plateaus; central and northern Nevada/Utah	Small evergreen trees, large shrubs, perennial herbs and grasses	Overgrazing; vegetation removal from mining operations; airborne pollutants, off-road vehicles

loams, while the subsoils range from sands to loamy skeletal to fine loamy. Cemented hardpans are common at varying depths below the surface. In general, the gravel content of the deposits increases near the base of mountains. Permeability of these soils ranges from slow to rapid.

4. Uplands and mountains have shallow to deep, moderately alkaline to medium acid soils. Surface textures range from cobbly to sandy to gravelly loams, while the subsoils range from loamy skeletal to clayey skeletal. These soils are often underlain by bedrock.

A surface pavement of rock fragments is present over many of the soils. It is caused by winds which remove the finer soil particles from the surface.

Wildlife (3.2.2.6)

Non-game Species (3.2.2.6.1)

Non-game terrestrial animals of the study area are listed in Tables 3.2.2.6.1-1, 3.2.2.6.1-2, and 3.2.2.6.1-3. Nocturnal rodents account for most of the small mammals and are quite abundant, with many species inhabiting the Great Basin. Reptile diversity is low as a result of relatively low mean annual temperatures and low habitat diversity as compared to the Mojave and Sonoran deserts to the south. Low amphibian diversity results from general aridity, lack of summer rains, and isolation from colonizing sources; only a few species have been introduced or have survived in isolated springs and small streams since the last glacial period. The areas with the highest bird diversity in the study area are in the mountains and riparian habitat.

Game Animals (3.2.2.6.2)

Big game species in the Nevada/Utah study area include mule deer, pronghorn, bighorn sheep, elk (Figures 3.2.2.6-1, 3.2.2.6-2, 3.2.2.6-3, and 3.2.2.6-4) and mountain lion. Wide ranges of habitats are found, including basins, high mountain ranges, forests, woodlands, and scrublands.

Wetlands in valleys are important stopover areas or breeding habitat for large numbers of migratory waterfowl (Figure 3.2.2.6-5), and shorebirds.

Important upland game includes a variety of grouse species, mourning dove, pheasant, quail, chuckar, partridge, and cottontail rabbits. The distributions of sage grouse, blue grouse, quail, and chukar partridge are shown in Figures 3.2.2.6-7, 3.2.2.6-7, and 3.2.2.6-8.

Major furbearers are mink, raccoon, badger, skunk, weasel, bobcat, coyote, fox, beaver, and muskrat.

Refer to ETR-15, "Wildlife", for a more detailed discussion of game and non-game wildlife in the M-X study area.

Table 3.2.2.6.1-1 Amphibians and reptiles of the Nevada/Utah M-X study area.

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Aquatic	Riparian	Sand dune-Sandy	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brush
				Habitat Types						
Amphibians										
Frogs and Toads										
Great Basin spadefoot	Scaphiopus intermontanus	C	T	X	X			X	X	
Western toad	Bufo boreas	C	W	X	X					
Great Plains toad	Bufo cognatus	R	S	X	X			X		
Woodhouse's toad	Bufo woodhousei	R	E	X	X			X		
Pacific tree frog	Hyla regilla	C	W	X	X					
Red-legged frog	Rana aurora	R	2 Valleys	X						
Bullfrog	Rana catesbeiana	R	W	X						
Leopard frog	Rana pipiens	C	T	X						
Reptiles										
Lizards										
Zebra-tailed lizard	Callisaurus draconoides	C	W&S			X	X			
Long-nosed leopard lizard	Gambelia wislizenii	C	T			X	X	X		
Collared lizard	Crotophytus collaris	C	T				X	X		
Desert spiny lizard	Sceloporus magister	C	W&S		X		X		X	
Western fence lizard	Sceloporus occidentalis	C	T		X			X	X	X
Sagebrush lizard	Sceloporus graciosus	C	T		X		X	X	X	X
Side-blotched lizard	Uta stansburiana	C	T			X	X	X	X	
Short-horned lizard	Phrynosoma douglassi	R	N				X	X		
Desert horned lizard	Phrynosoma platyrhinos	C	T			X	X	X		
Western skink	Eumeces skiltonianus	C	T					X	X	X
Western whiptail	Cnemidophorus tigris	C	T			X	X	X	X	X
Snakes										
Rubber boa	Charina bottae	R	NW							X
Ring-necked snake	Diadophis punctatus	R	C		X					X
Coachwhip	Masticophis flagellum	C	W&S				X			
Striped whipsnake	Masticophis taeniatus	C	T		X			X	X	X
Western patch-nosed snake	Salvadora hexalepis	C	W&S			X	X			
Gopher snake	Pituophis melanoleucus	C	T				X	X	X	X
Common kingsnake	Lampropeltis getulus	C	W&S		X				X	X
Long-nosed snake	Rhinocheilus lecontei	C	T			X	X			
Western terrestrial garter snake	Thamnophis elegans	C	N		X					X
Western ground snake	Sonora semiannulata	C	W&S			X		X		
Night snake	Hypsiglena torquata	C	T			X		X		
Western rattlesnake	Crotalus viridis	C	T			X	X	X	X	

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[1] C = Common; R = Rare

[2] T = Throughout; N = Northern; S = Southern; E = Eastern; W = Western; NW = Northwestern; C = Central

Sources: Banta, 1965; Bernard and Brown, 1977; Stebbins, 1966.

Table 3.2.2.6.1-2. Mammals of the Nevada/Utah M-X study area. (Page 1 of 3)

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types: Aquatic	Riparian	Sand dune-Sandy	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brush
Mammals										
Insectivores										
Merriam shrew	Sorex merriami	C	T					X		
Vagrant shrew	Sorex vagrans	R	N		X					
Northern water shrew	Sorex palustris	C	N	X	X					
Bats										
Little brown myotis	Myotis lucifugus	C	T		X				X	X
Fringed myotis	Myotis thysanodes	C	T					X	X	X
Long-eared myotis	Myotis evotis	C	T					X	X	X
California myotis	Myotis californicus	C	T				X		X	X
Yuma myotis	Myotis yumanensis	C	T		X		X	X		
Long-legged myotis	Myotis volans	C	T		X				X	X
Small-footed myotis	Myotis subulatus	C	T		X				X	X
Silver-haired bat	Lasionycterus noctivagans	C	T		X					X
Western pipistrel	Pipistrellus hesperus	C	T		X		X	X	X	
Big brown bat	Eptesicus fuscus	C	T		X				X	X
Hoary bat	Lasiurus cinereus	C	T						X	X
Spotted bat	Euderma maculata	R	T		X				X	X
Western big-eared bat	Plecotus townsendi	C	T				X	X	X	X
Pallid bat	Antrozous pallidus	C	T				X	X		
Big freetail bat	Tadarida molossa	C	T				X	X	X	
Mexican freetail bat	Tadarida brasiliensis	C	T				X	X	X	
Carnivores										
Ringtail	Bassariscus astutus	R	E&S		X				X	X
Short-tailed weasel	Mustela erminea	R	N		X				X	X
Long-tailed weasel	Mustela frenata	C	T		X			X	X	X
Badger	Taxidea taxus	C	T				X	X	X	
Spotted skunk	Spilogale gracilis	C	T		X		X	X	X	X
Striped skunk	Mephitis mephitis	C	T		X		X	X	X	X
Coyote	Canis latrans	C	T				X	X	X	X
Kit fox	Vulpes macrotis	C	T			X	X	X	X	
Red fox	Vulpes fulva	R	T						X	X
Gray fox	Urocyon cinereoargenteus	C	T						X	X
Mountain lion	Felis concolor	R	T							X
Bobcat	Lynx rufus	C	T		X			X	X	X

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Table 3.2.2.6.1-2. Mammals of the Nevada/Utah M-X study area. (Page 2 of 3)

	Species	Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types: Aquatic	Riparian	Sand dune-Sandy	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brush
Rodents										
Yellow-bellied marmot	Marmota flaviventris	C	W					X	X	X
Utah prairie dog	Cynomys parvidens	R	ST				X	X	X	X
Rock squirrel	Spermophilus variegatus	C	T				X	X	X	
Townsend ground squirrel	Spermophilus townsendi	C	T					X		
Belding ground squirrel	Spermophilus beldingi	R	W						X	X
Golden-mantled squirrel	Spermophilus lateralis	C	N&E							X
White-tailed antelope ground squirrel	Ammospermophilus leucurus	C	T			X	X		X	
Least chipmunk	Eutamias minimus	C	T				X	X	X	X
Cliff chipmunk	Eutamias dorsalis	C	T						X	X
Unita chipmunk	Eutamias umbrinus	C	W&C							X
Valley pocket gopher	Thomomys bottae	C	T				X	X	X	X
Little pocket mouse	Perognathus longimembris	C	T			X	X	X	X	
Great Basin pocket mouse	Perognathus parvus	C	T				X	X	X	X
Long-tailed pocket mouse	Perognathus formosus	C	S&E					X	X	
Dark kangaroo mouse	Microdipodops megacephalus	C	T			X	X	X		
Pale kangaroo mouse	Microdipodops pallidus	R	W			X	X			
Ord kangaroo rat	Dipodomys ordi	C	T			X	X	X		
Great Basin kangroo rat	Dipodomys microps	C	T			X	X	X	X	
Western harvest mouse	Reithrodontomys megalotis	C	T		X		X	X		
Canyon mouse	Peromyscus crinitus	C	T					X	X	
Deer mouse	Peromyscus maniculatus	C	T				X	X	X	X
Pinyon mouse	Peromyscus truei	C	T						X	
Northern grasshopper mouse	Onychomys leucogaster	C	T			X	X	X		
Southern grasshopper mouse	Onychomys torridus	R	S			X	X			
Desert woodrat	Neotoma lepida	C	T				X	X	X	
Bushy-tailed woodrat	Neotoma cinerea	R	N					X	X	X
Mountain vole	Microtus montanus	C	T					X		X
Long-tailed vole	Microtus longicaudus	C	T		X			X		X
Sagebrush vole	Lagurus curtatus	C	T				X	X		
Porcupine	Erethizon dorsatum	C	T					X	X	X

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Table 3.2.2.6.1-2. Mammals of the Nevada/Utah M-X study area. (Page 3 of 3)

	Species	Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types: Aquatic	Riparian	Sand dune-Sandy	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brush
Rabbits										
White-tailed jackrabbit	Lepus townsendi	C	T					X		X
Black-tailed jackrabbit	Lepus californicus	C	T				X	X	X	
Mountain cottontail	Sylvilagus nuttalli	C	T					X	X	X
Pygmy rabbit	Sylvilagus idahoensis	C	T					X		
Desert cottontail	Sylvilagus auduboni	C	T				X	X	X	
Hooved Animals										
Wild horses	Equus caballus	C	T				X	X	X	
Elk	Cervus elaphus	R	Only a few mountains						X	X
Mule deer	Odocoileus hemionus	C	T					X	X	X
Pronghorn	Antilocapra americana	C	T				X	X		
Bighorn sheep	Ovis canadensis	R	T							X

T4713/9-4-81/F

[1]C - Common; R - Rare

[2]T - Throughout; N - Northern; S - Southern; E = Eastern; W - Western; SE - Southeastern

Sources: Bernard and Brown, 1977
Burt and Grossenheider, 1976
Durrant, 1952
Hall, 1946

Table 3.2.2.6.1-3. Birds of the Nevada/Utah M-X study area. (Page 1 of 7)

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian and Wet Meadow	Tree Plantation	Shadscale Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brushland
Grebes (Podicipediformes)										
Eared grebe	Podiceps nigricollis	C	T	S						
Western grebe	Aechmophorus occidentalis	U	T	S						
Pied-billed grebe	Podilymbus podiceps	C	T	P						
Pelicans (Pelecaniformes)										
White Pelican	Pelecanus erythrorhynchos	C	T	S						
Herons (Ciconiiformes)										
Great blue heron	Ardea herodias	C	T	P	P					
Great egret	Casmerodius albus	U	W	P	P					
Snowy egret	Egretta thula	C	T	S	S					
Black-crowned night heron	Nycticorax nycticorax	U	T	P	P					
American bittern	Botaurus lentiginosus	U	T	S	S					
White-faced ibis	Plegadis chihi	C	T	S	S					
Ducks, Geese, and Swans (Anseriformes)										
Whistling swan	Olor columbianus	U	W	W						
Canada goose	Branta canadensis	C	T	P						
Snow goose	Chen caerulescens	U	T	W						
Mallard	Anas platyrhynchos	C	T	P						
Gadwall	Anas strepera	C	T	P						
Pintail	Anas acuta	C	T	P						
Green-winged teal	Anas crecca	C	T	P						
Blue-winged teal	Anas discors	R	T	S						
Cinnamon teal	Anas cyanoptera	C	T	S						
American wigeon	Anas americana	U	T	P						
Northern shoveler	Anas clypeata	C	T	P						
Redhead	Aythya americana	C	T	P						
Canvasback	Aythya valisineria	U	T	M						
Ring-necked duck	Aythya collaris	C	T	M						
Lesser scaup	Aythya affinis	C	T	M						
Common goldeneye	Bucephala clangula	U	W	M						
Bufflehead	Bucephala albeola	U	W	W						
Ruddy duck	Oxyura jamaicensis	C	T	P						
Common merganser	Mergus merganser	U	T	M						

T4714/9-4-81/F

Table 3.2.2.6.1-3. Birds of the Nevada/Utah M-X study area. (Page 2 of 7)

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian and Wet Meadow	Tree Plantation	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brushland
Raptors (Falconiformes)										
Turkey vulture	Cathartes aura	C	T		S	S	S	S	S	S
Goshawk	Accipiter gentilis	R	T						M	S
Sharp-shinned hawk	Accipiter striatus	U	T		P	P				P
Cooper's hawk	Accipiter cooperii	U	T		P	P			P	P
Red-tailed hawk	Buteo jamaicensis	C	T		P	P	P	P	P	P
Swainson's hawk	Buteo swainsoni	U	T				S	S	S	
Rough-legged hawk	Buteo lagopus	C	T				W	W		
Ferruginous hawk	Buteo regalis	U	T				P	P		
Golden eagle	Aquila chrysaetos	U	T		P	P	P	P	P	P
Bald eagle	Haliaeetus leucocephalus	R	T	W	W	W	W	W		W
Marsh hawk	Circus cyaneus	U	T	P	P	P	P	P		
Prairie falcon	Falco mexicanus	U	T		P	P	P	P	P	
Peregrine falcon	Falco peregrinus	R	T	M	M			M	M	M
American kestrel	Falco sparverius	U	T		P	P	P	P	P	P
Grouse (Galliformes)										
Blue grouse	Dendragopus obscurus	U	W							P
Sage grouse	Centrocercus urophasianus	C	T		P			P		
Gambel's quail	Lophortyx gambelii	C	S		P	P	P			
Mountain quail	Oreortyx pictus	R	W							P
Chukar	Alectoris chukar	C	T		P		P	P	P	P
Ring-necked pheasant	Phasianus colchicus	R	S&E		P	P				
Cranes (Gruiformes)										
Sandhill crane	Grus canadensis	U	T	M	M					
Virginia rail	Rallus limicola	C	T	S	S					
Sora	Porzana carolina	C	T	P	P					
American coot	Fulica americana	C	T	P						
Shorebirds (Charadriiformes)										
Killdeer	Charadrius vociferus	C	T	P						
Black-bellied plover	Pluvialis squatarola	U	T	M						
Common snipe	Capella gallinago	C	T	P	P					
Long-billed curlew	Numenius americanus	U	T	M						
Spotted sandpiper	Actitis macularia	U	T	M						
Greater yellowlegs	Tringa melanoleuca	U	T	M						
Lesser yellowlegs	Tringa flavipes	C	T	M						
Willet	Catoptrophorus semipalmatus	C	T	SM						
Least sandpiper	Calidris minutilla	U	T	M						
Western sandpiper	Calidris mauri	U	T	M						

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Table [illegible]. Birds of the Nevada/Utah M-X study area. (Page 3 of 7)

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3] Aquatic and Shoreline	Riparian and Wet Meadow	Tree Plantation	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland[4]	Montane Forest and Brushland
Shorebirds (Charadriiformes) (continued)										
Dunlin	Calidris alpina	R	T	M						
Long-billed dowitcher	Limnodromus scolopaceus	C	T	M						
Marbled godwit	Limosa fedoa	R	T	M						
American avocet	Recurvirostra americana	C	T	S						
Black-necked stilt	Himantopus mexicana	U	T	S						
Wilson's phalarope	Steganopus tricolor	C	T	S						
Northern phalarope	Lobipes lobatus	U	T	M						
California gull	Larus californicus	C	T	M						
Ring-billed gull	Larus delawarensis	C	T	P						
Forster's tern	Sterna forsteri	C	T	S						
Black tern	Chlidonias niger	U	T	M						
Doves (Columbiformes)										
Mourning dove	Zenaida macroura	C	T	S	S	S		S	S	S
Owls (Strigiformes)										
Barn owl	Tyto alba	R	T		P	P		P		
Screech owl	Otus asio	R	T			P			P	P
Great-horned owl	Bubo virginianus	U	T		P	P		P	P	P
Burrowing owl	Athene cunicularia	R	T				P			
Long-eared owl	Asio otus	U	T		P				P	P
Short-eared owl	Asio flammeus	U	T		P					
Nightjars (Caprimulgiformes)										
Poor-will	Phalaenoptilus nuttallii	C	T		M	M			S	S
Common nighthawk	Chordeiles minor	C	T	S	S			S	S	
Swifts and Hummingbirds (Apodiformes)										
White-throated swift	Aeronautes saxatalis	C	T				S	S	S	S
Broad-tailed hummingbird	Selasphorus platycercus	C	T		S	S				S
Rufous hummingbird	Selasphorus rufus	C	T		M	M			M	M
Calliope hummingbird	Stellula calliope	U	T		M					M
Kingfishers (Coraciiformes)										
Belted kingfisher	Megaceryle alcyon	U	T	P	P					

T4715/9-4-81-F

Table 3.2.2.6.1-3. Birds of the Nevada/Utah M-X study area. (Page 4 of 7)

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian and Wet Meadow	Tree Plantation	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brushland
Woodpeckers (Piciformes)										
Common flicker	Colaptes auratus	C	T		P	P			P	P
Yellow-bellied sapsucker	Sphyrapicus varius	R	T		M	M			M	S
Hairy woodpecker	Dendrocopos villosus	C	T		P	P			P	P
Downy woodpecker	Dendrocopos pubescens	C	T		P	P			P	P
Perching Birds (Passeriformes)										
Flycatchers (Tyrannidae)										
Western kingbird	Tyrannus verticalis	C	T		S	S	S		S	
Ash-throated flycather	Myiarchus cinerascens	C	T		S	S			S	
Say's phoebe	Sayornis saya	C	T		S	S			S	
Willow flycatcher	Empidonax traillii	U	T		S					
Hammond's flycatcher	Empidonax hammondii	U	T							S
Dusky flycatcher	Empidonax oberholseri	C	T							S
Gray flycatcher	Empidonax wrightii	C	T					S	S	
Western flycatcher	Empidonax difficilis	U	T							S
Western wood pewee	Contopus sardidulus	C			S	S				S
Larks (Alaudidae)										
Horned lark	Eremephila alpetris	C	T				P			
Swallows (Hirundinidae)										
Violet-green swallow	Tachycineta thalassina	C	T	S	S	S	S	S	S	S
Tree swallow	Ir. Ioprocne bicolor	C	T	S	S	S	S	S	S	S
Bank swallow	Riparia riparia	R	T	S	S					
Rough-winged swallow	Stelgidopteryx ruficollis	C	T	S	S					
Barn swallow	Hirundo rustica	C	T	S	S	S	S	S		
Cliff swallow	Petrochelidon pyrrhonota	C	T	S	S	S	S	S		
Crows (Corvidae)										
Steller's jay	Cyanocitta stelleri	C	T							P
Scrub jay	Aphelocoma coerulescens	C	T		P				P	
Black-billed magpie	Pica pica	C	T		P	P		P	P	
Raven	Corvus corax	C	T		P	P	P	P	P	P
Pinyon jay	Gymnorhinus cyanocephalus	C	T					P	P	
Clark's nutcracker	Nucifraga columbiana	U	T							P

FY13/9.6.81/F

AD-A149 879 DEPLOYMENT AREA SELECTION AND LAND WITHDRAWAL/ACQUISITION CHAPTER 3 M-X/M..(U) HENNINGSON DURHAM AND RICHARDSON SANTA BARBARA CA 02 OCT 81 2/5

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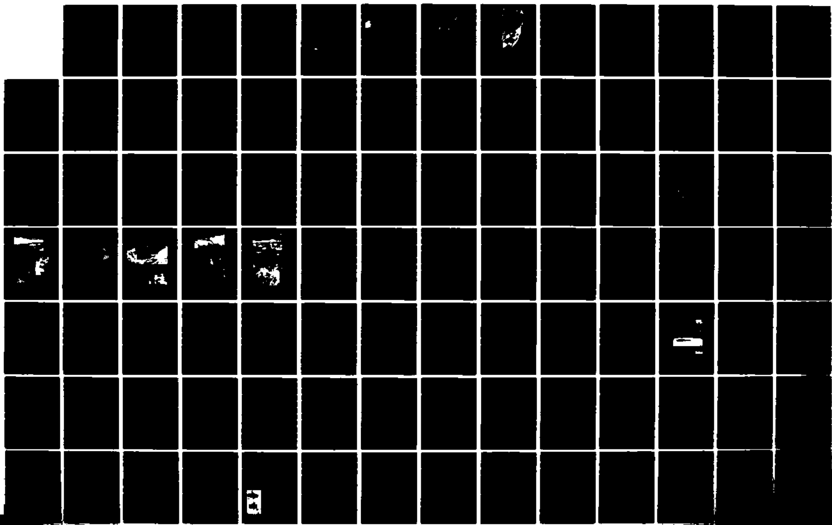

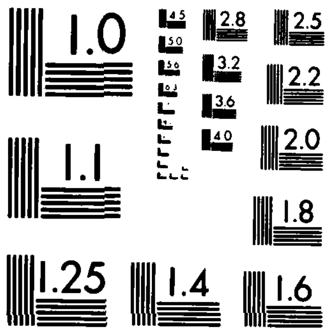

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NATIONAL BUREAU OF STANDARDS-1963-A

Table 3.2.2.6.1-3 Birds of the Nevada/Utah M-X study area. (Page 5 of 7)

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian and Wet Meadow	Tree Plantation	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brushland
Bushtits (Paridae)										
Black-capped chickadee	Parus atricapillus	C	E		P	P				
Mountain chickadee	Parus gambeli	C	T						P	P
Plain titmouse	Parus inornatus	R	T		P	P			P	
Bushtit	Psattriparus minimus	C	T		P	P			P	P
Nuthatches (Sittidae)										
White-breasted nuthatch	Sitta carolinensis	C	W						P	P
Red-breasted nuthatch	Sitta canadensis	C	T							P
Pygmy nuthatch	Sitta pygmaea	C	W&S							P
Creepers (Certhiidae)										
Brown creeper	Certhia familiaris	C	T			P				P
Dippers (Cinclidae)										
Dipper	Cinclus mexicanus	C	T	P	P					
Wrens (Troglodytidae)										
House wren	Troglodytes aedon	C	T		S	S				
Long-billed marsh wren	Telmatodytes palustris	C	T	P	P					
Canyon wren	Catherpes mexicanus	U	T						P	
Rock wren	Salpinctes obsoletus	C	T					P	P	
Thrashers (Mimidae)										
Sage thrasher	Oreoscoptes montanus	C	T					S	S	
Thrushes (Turdidae)										
American robin	Turdus migratorius	C	T		P	P				P
Hermit Thrush	Catharus guttata	C	T		M	M			S	S
Swainson's thrush	Catharus ustulata	R	T		M	M				S
Western bluebird	Sialia mexicana	C	T			S			S	
Mountain bluebird	Sialia currucoides	C	T							S
Townsend's solitaire	Myadestes townsendi	C	T						S	S
Kinglets (Sylviidae)										
Blue-gray gnatcatcher	Polioptila caerulea	C	T		S				S	
Golden-crowned kinglet	Regulus satrapa	U	T			M				P
Ruby-crowned kinglet	Regulus calendula	C	T		M	M			M	M

T4714/9-4-81/F

Table 3.2.2.6.1-3 Birds of the Nevada/Utah M-X study area. (Page 6 of 7)

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian and Wet Meadow	Tree Plantation	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brushland
Pipits (Motacillidae)										
Water pipit	Anthus spinoletta	U	T	W	W					
Waxwings (Bombycillidae)										
Cedar waxwing	Bombycilla cedrorum	C	T		W	W			W	S
Shrikes (Laniidae)										
Northern shrike	Lanius excubitor	R	T			W	W	W		
Loggerhead shrike	Lanius ludovicianus	C	T			P	P		P	
Starlings (Sturnidae)										
Starling	Sturnus vulgaris	C	T		P	P				
Vireos (Vireonidae)										
Solitary vireo	Vireo solitarius	C	W		M	M			S	S
Warbling Vireo	Vireo gilvus	C	T		M	M				S
Gray Vireo	Vireo vicinior	C	T		M	M			S	
Warblers (Parulidae)										
Orange-crowned warbler	Vermivora celata	U	T		M	M				S
Virgina's warbler	Vermivora virginiae	U	T						M	S
Yellow warbler	Dendroica petechia	C	T		S	S				
Yellow-rumped warbler	Dendroica coronata	C	T		M	M				S
Black-throated gray warbler	Dendroica nigrescens	C	T		M	M			S	
MacGillivray's warbler	Oporonis tolmiei	U	T		M	M				S
Common yellowthroat	Geothlypis trichas	C	T		S	M				
Yellow-breasted chat	Icteria virens	U	T		S	S				
Wilson's warbler	Wilsonia pusilla	C	T		M	M				
House Sparrows (Ploceidae)										
House sparrow	Passer domesticus	C	T		P	P				
Blackbirds (Icteridae)										
Western meadowlark	Sturnella neglecta	C	T		P					
Yellow-headed blackbird	Xanthocephalus xanthocephalus	C	T	S	S					
Red winged blackbird	Agelaius phoeniceus	C	T	S	S	M				
Northern oriole	Icterus galbula	C	T		S	S				
Brewer's blackbird	Euphagus cyanocephalus	C	T		M	P		P		
Brown-headed cowbird	Molothrus ater	C	T		S	S			S	S

T4714/9-4-81/F

Table 3.2.2.6.1-3 Birds of the Nevada/Utah M-X study area. (Page 7 of 7)

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian and Wet Meadow	Tree Plantation	Shadscale-Greasewood	Big Sage	Pinyon-Juniper Woodland	Montane Forest and Brushland
Tanagers (Thraupidae)										
Western tanager	Piranga ludoviciana	U	T		M	M				S
Sparrows and Finches (Fringillidae)										
Black-headed grosbeak	Pheucticus melanocephalus	U	T		S	M				S
Lazuli bunting	Passerina amoena	U	T		S	S				
Evening grosbeak	Hesperiphona vespertina	U	T		W	W			W	P
Cassin's finch	Carpodacus cassinii	U	T							P
House finch	Carpodacus mexicanus	C	T		P	P		P	P	
Pine siskin	Spinus pinus	C	T							P
American goldfinch	Spinus tristis	C	T		P	P				
Lesser goldfinch	Spinus psaltria	C	T		P	P				
Green-tailed towhee	Chlorura chlorura	U	T					S	S	S
Rufous-sided towhee	Pipilo erythrophthalmus	C	T		P	P			P	P
Savannah sparrow	Passerculus sandwichensis	C	T		P		P			
Vesper sparrow	Pooecetes gramineus	U	T				S	S		
Lark sparrow	Chondestes grammacus	U	T				S	S		
Black throated sparrow	Amphispiza bilineata	C	T				S	S		
Sage sparrow	Amphispiza belli	U	T				S	S		
Dark-eyed junco	Junco hyemalis	C	T		W	W		W	W	W
Gray-headed junco	Junco caniceps	C	T		W	W		W	W	S
Chipping sparrow	Spizella passerina	C	T		M	M		M	M	S
Brewer's sparrow	Spizella breweri	C	T			M		S	S	S
White-crowned sparrow	Zonothricia leucophrys	C	T		M	M	M	M	M	S
Fox sparrow	Passerella iliaca	R	T		S					S
Song sparrow	Melospiza melodia	C	T	P	P	P				

T4714/9-4-81/F

[1] C = Common; U = Uncommon; R = Rare.

[2] T = Throughout; S = Southern; E = Eastern; W = Western.

[3] Habitat types shown by season of use:

S = Summer; W = Winter visitant.
P = Permanent resident.
M = Migrant in spring and fall.

Sources: Behle and Perry, 1975; Hayward et al. 1976; Peterson, 1961; Ryser, 1970.

LEGEND

SOIL DISTRIBUTION IN THE NEVADA/UTAH STUDY AREA

HAPLARGIDS PLUS CALCIORTHIDS AND NATRARGIDS

HAPLARGIDS PLUS CALCIORTHIDS, NATRARGIDS AND CAMBORTHIDS

DURARGIDS PLUS DURORTHIDS AND CALCIORTHIDS

HAPLARGIDS PLUS PALEORTHIDS, TORRIORTHENTS AND ROCK LAND

HAPLARGIDS PLUS PALEORTHIDS, TORRIPSAMMENTS, PALEARGIDS AND CALCIORTHIDS

CAMBORTHIDS PLUS HAPLOXEROLLS

NATRARGIDS PLUS SALORTHIDS AND TORRIORTHENTS

SALT FLATS AND PLAYAS

1660-C-1

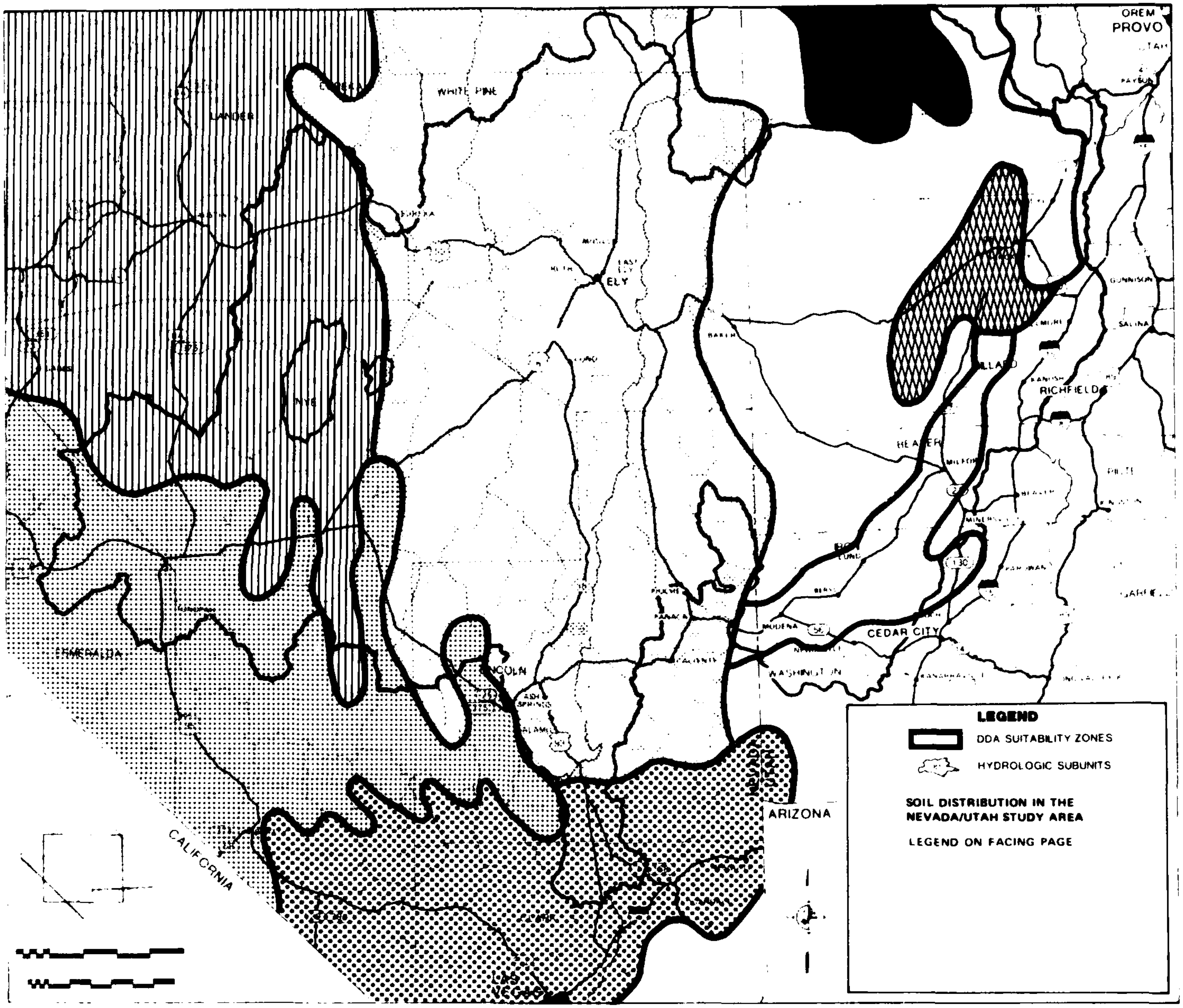
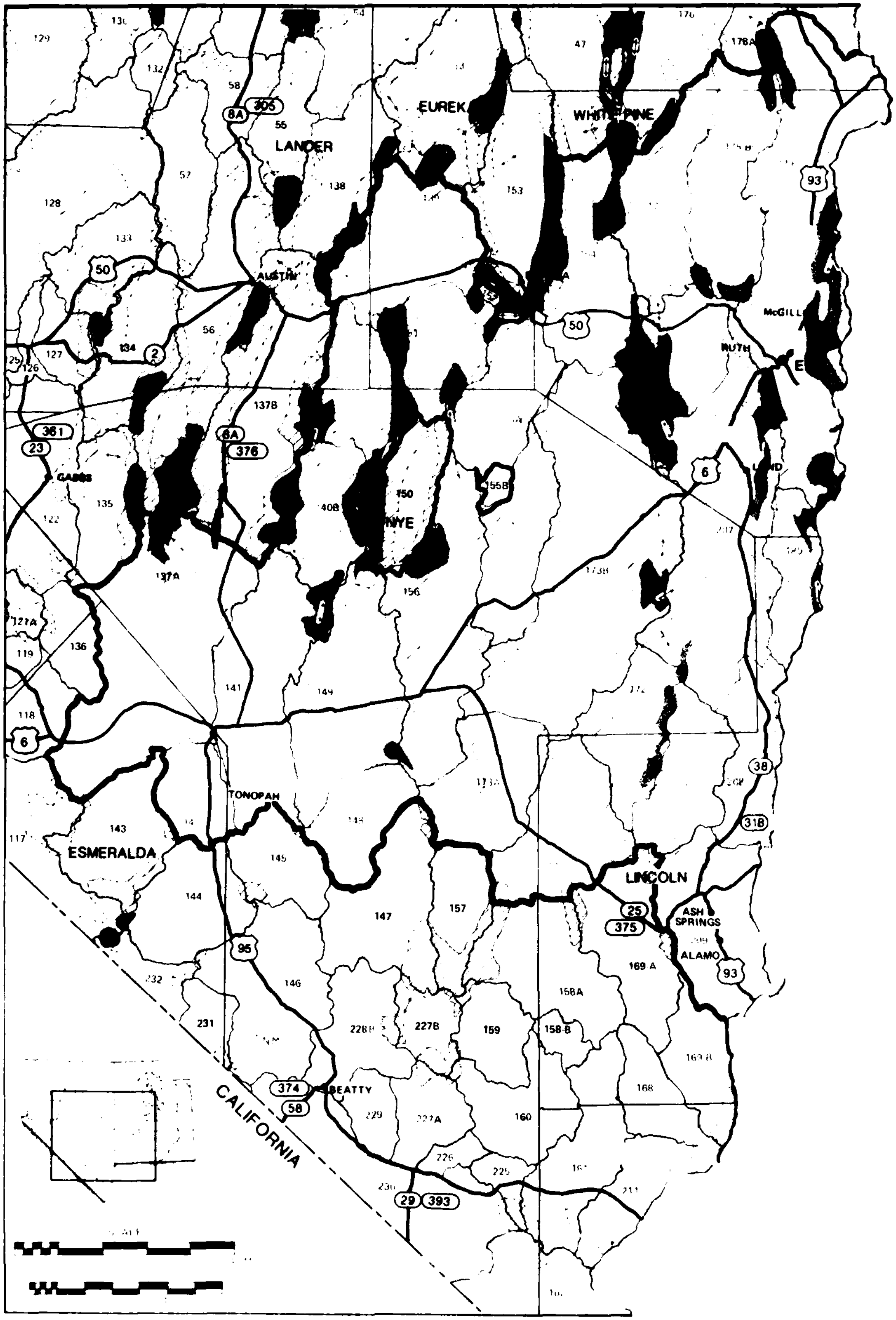


Figure 3.2.2.5-3. Soil types of the Nevada/Utah study area.



LANDER
EUREK
WHITE PINE
AUSTIN
McGILL
RUTH
NYE
GABBS
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
ALAMO
BEATTY
CALIFORNIA
50
6
93
95
8A
305
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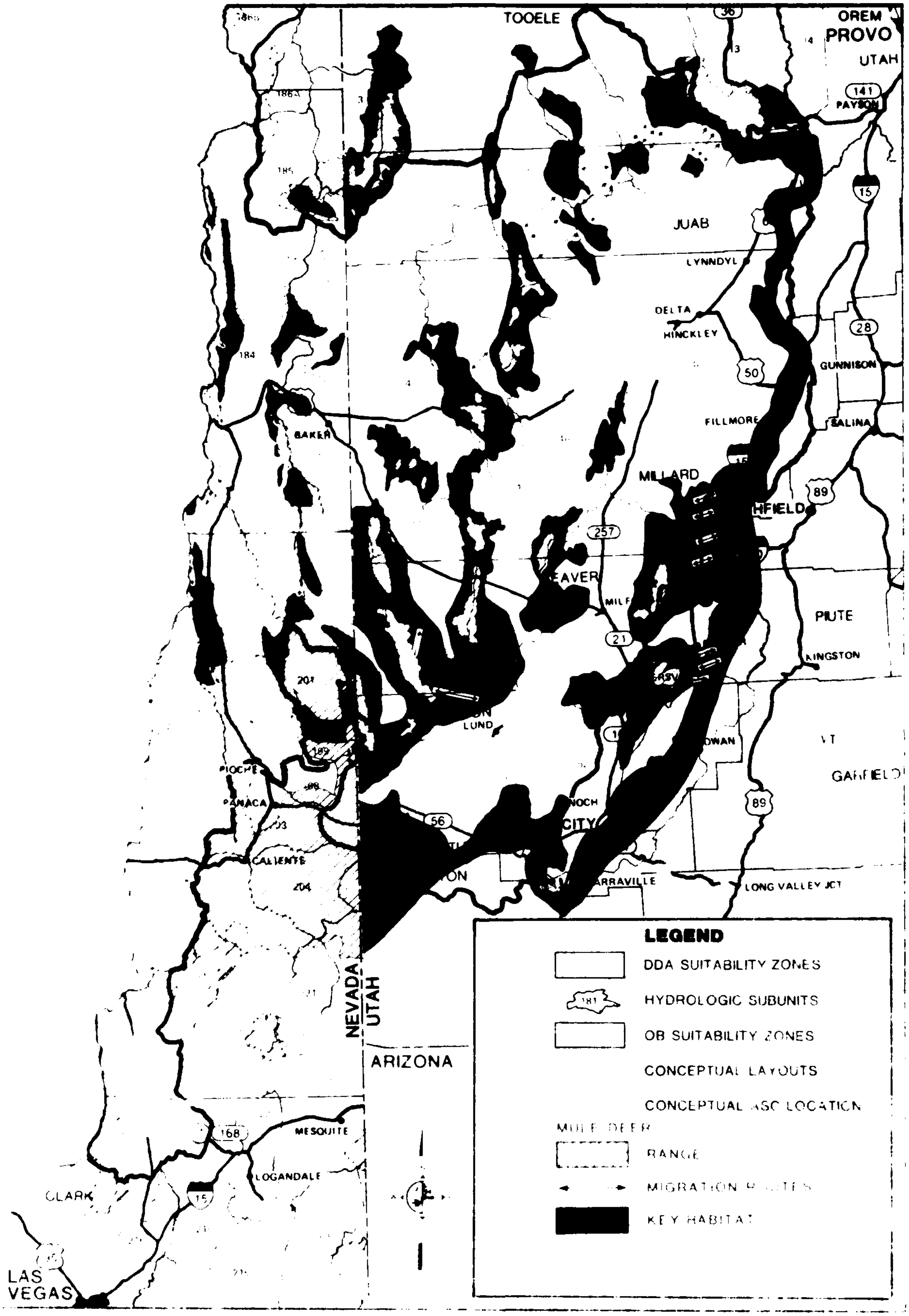
4459 D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OREM
PROVO
UTAH
PAYSON
JUAB
LYNNDYL
DELTA
HINCKLEY
GUNNISON
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SALINA
MILLARD
BAKER
PIUTE
KINGSTON
LUND
PIOCHE
PANACA
CALIENTE
GARFIELD
LONG VALLEY JCT
NEVADA
UTAH
ARIZONA
MESQUITE
LOGANDALE
CLARK
LAS VEGAS
LEGEND
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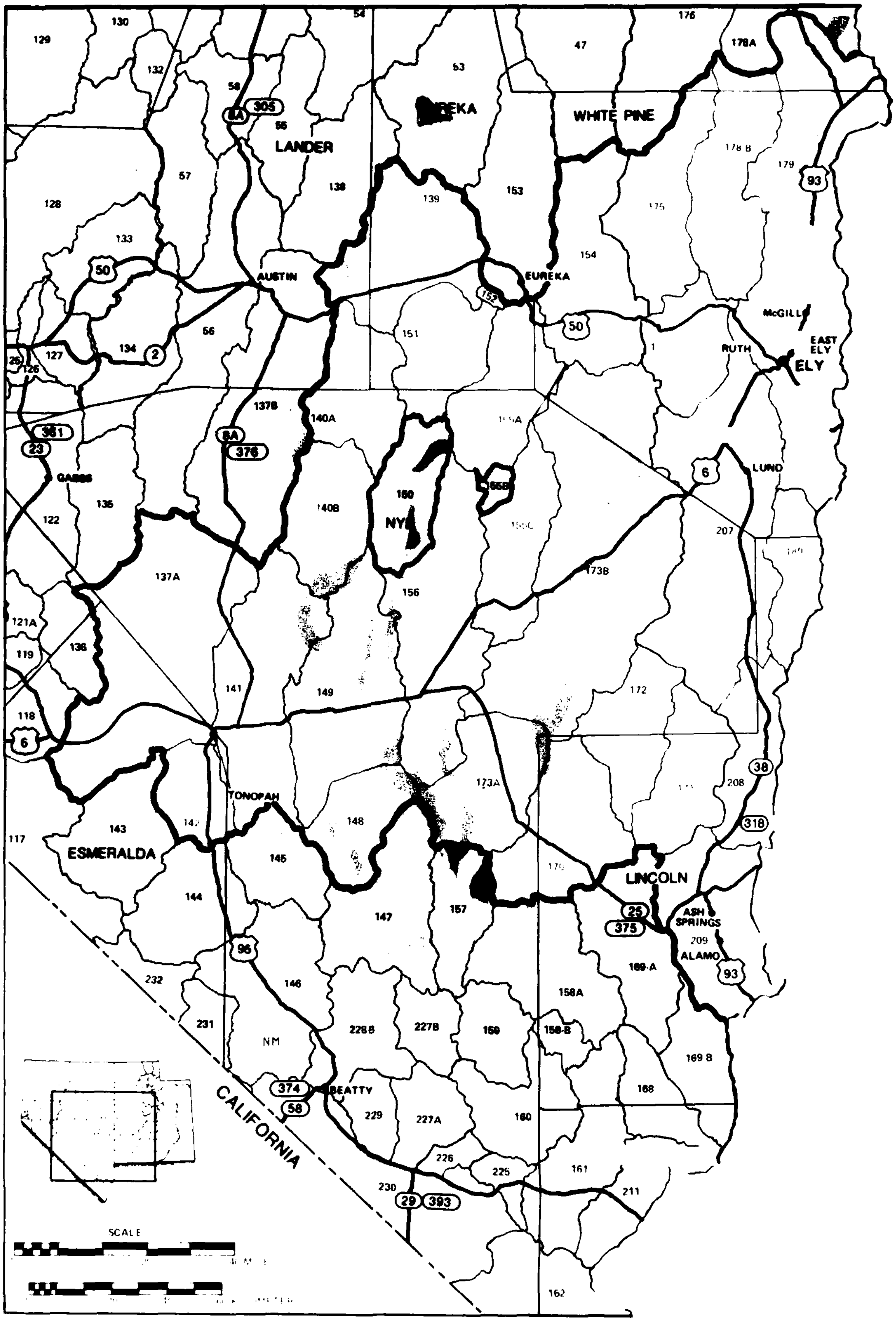
HYDROLOGIC SUBUNITS
OB SUITABILITY ZONES
CONCEPTUAL LAYOUTS
RANGE
KEY HABITAT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EUREKA
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LUND
GABBS
TONOPAH
ASH SPRINGS
ALAMO
BEATTY
SCALE

4459-D

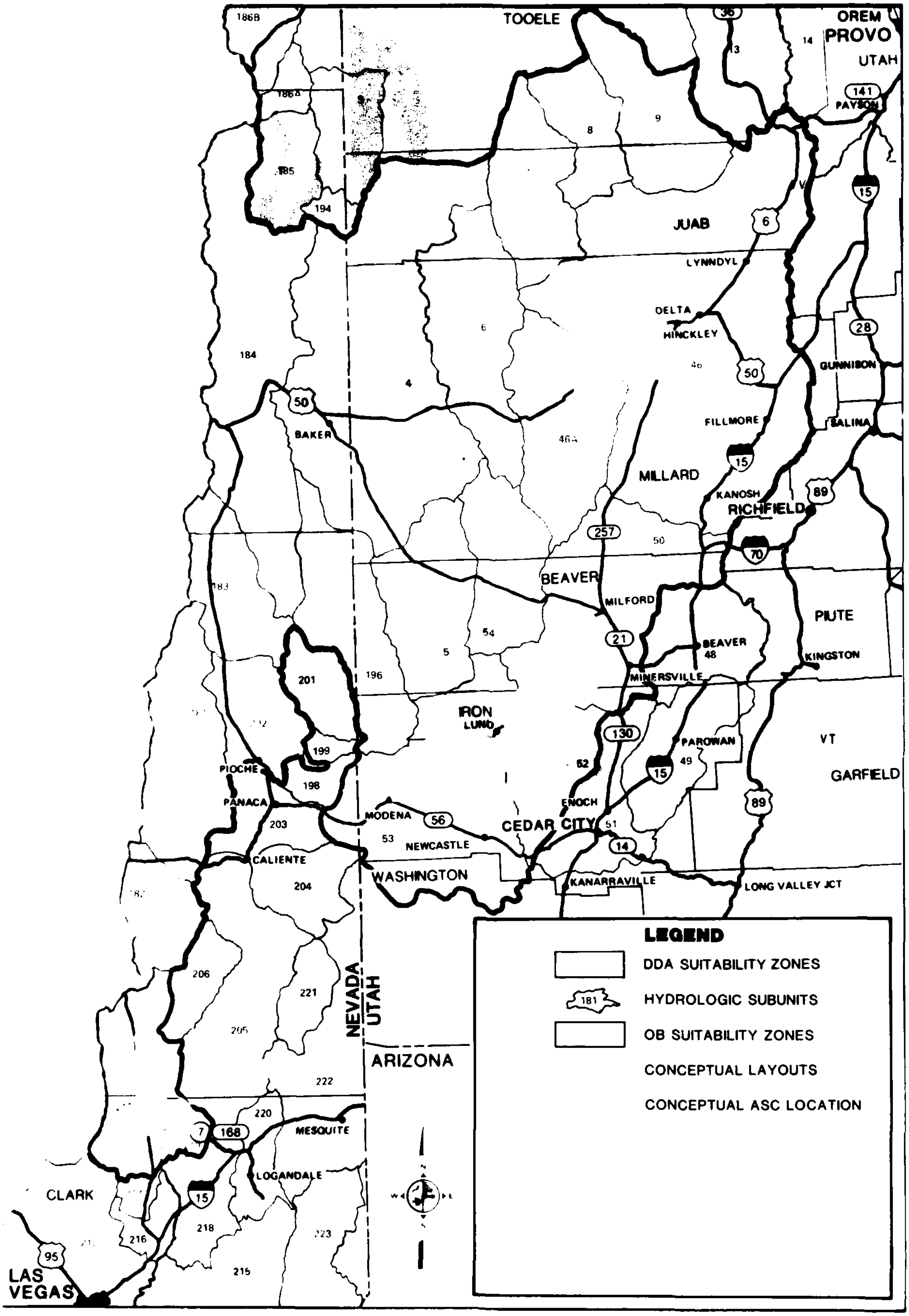
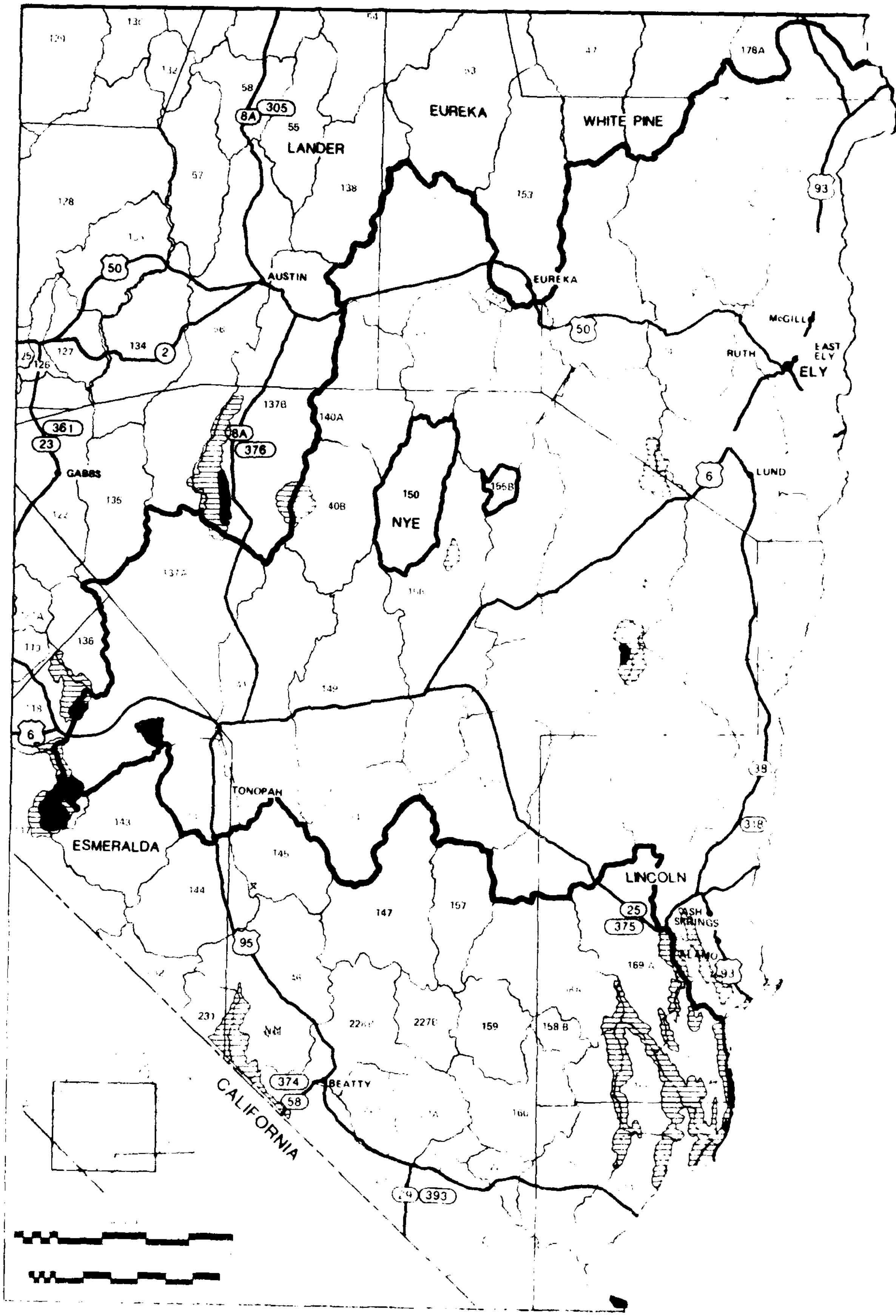


Figure 3.2.2.6-2. Pronghorn distribution in Nevada/Utah study area. 4458 D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WHITE PINE
LANDER
AUSTIN
EUREKA
McGILL
EAST ELY
RUTH
ELY
LUND
GABBS
NYE
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
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137B
140A
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155B
140B
135
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147
157
169 A
231
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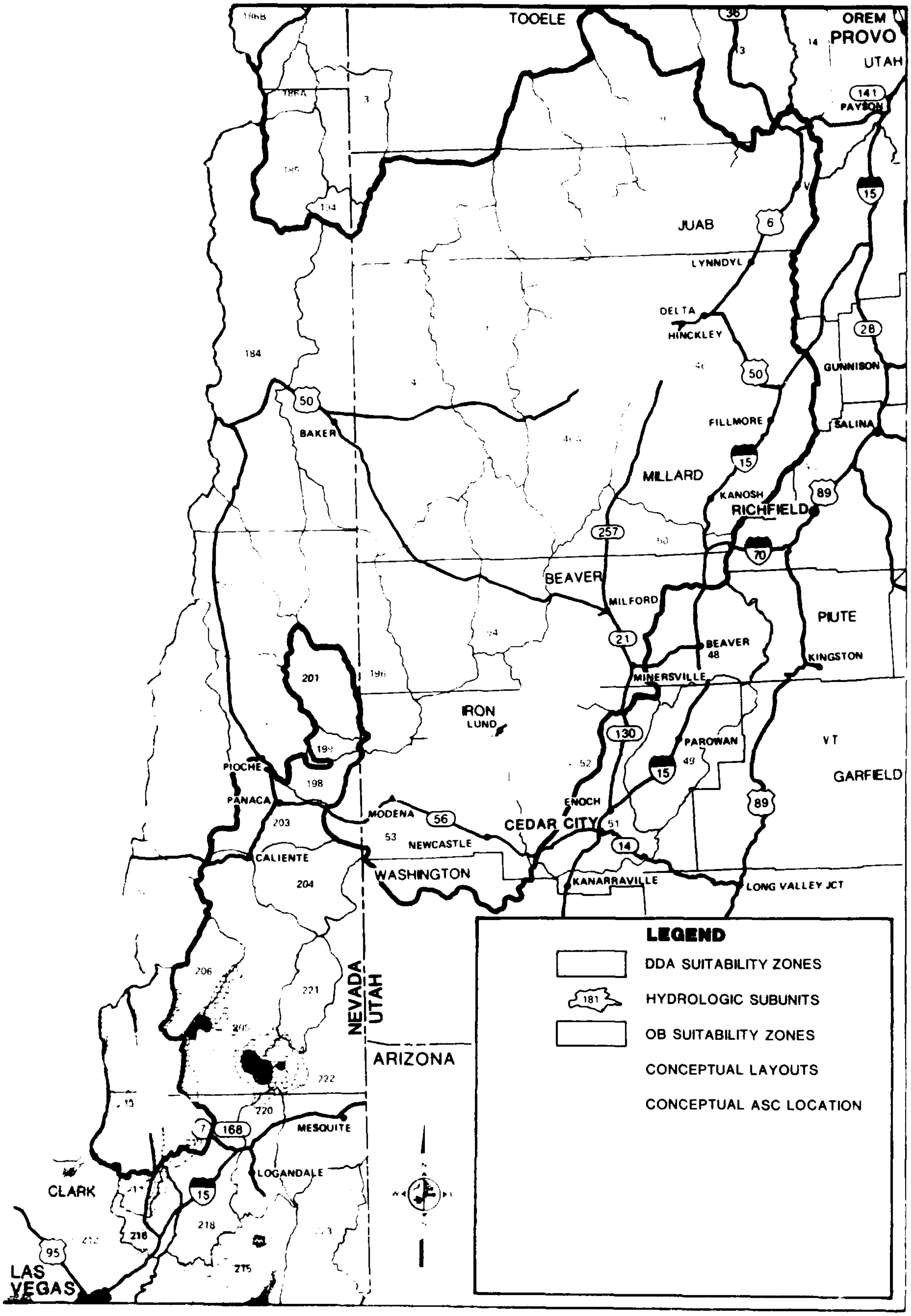

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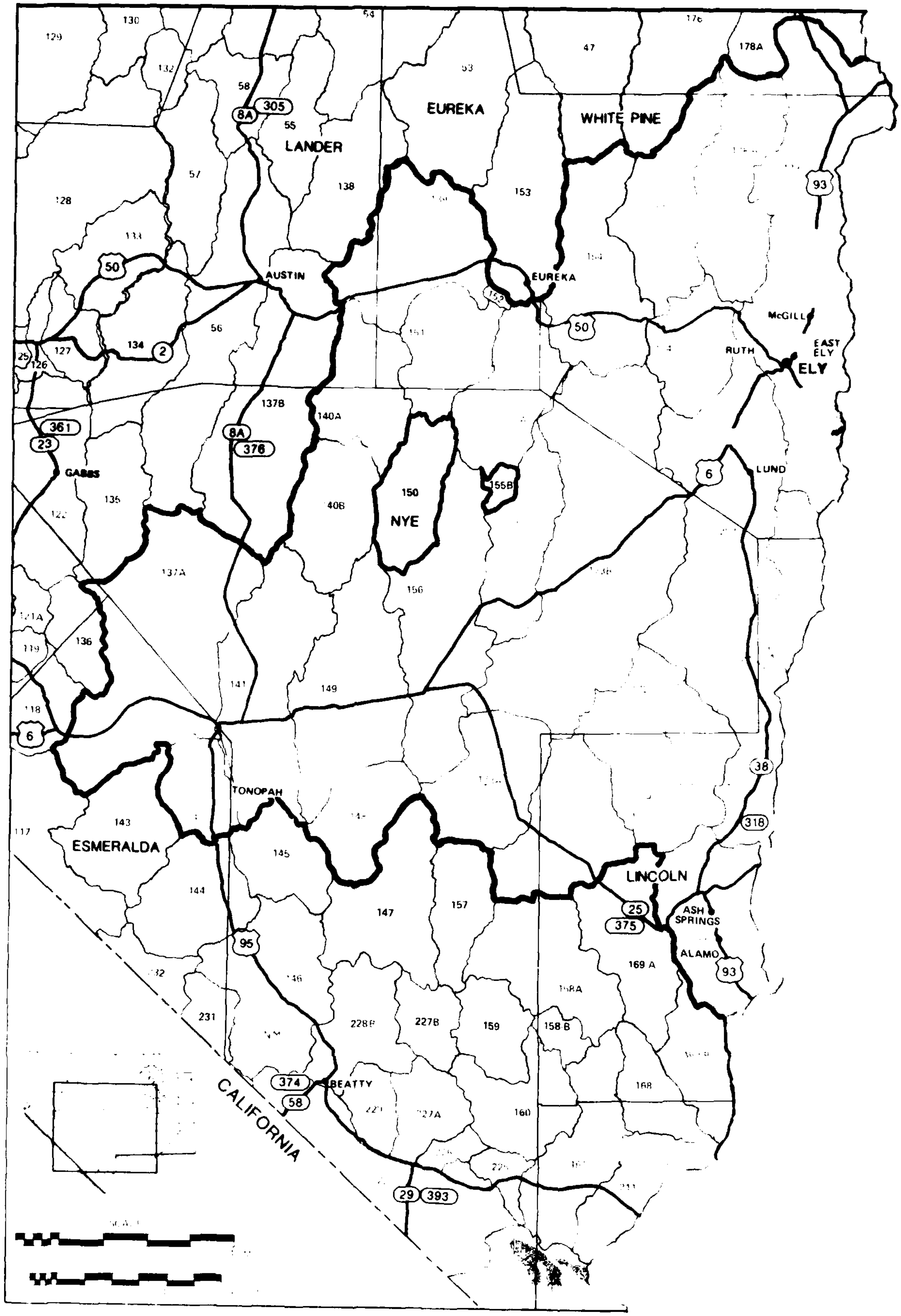
Figure 3.2.2.6-3. Bighorn sheep distribution in the Nevada/Utah study area.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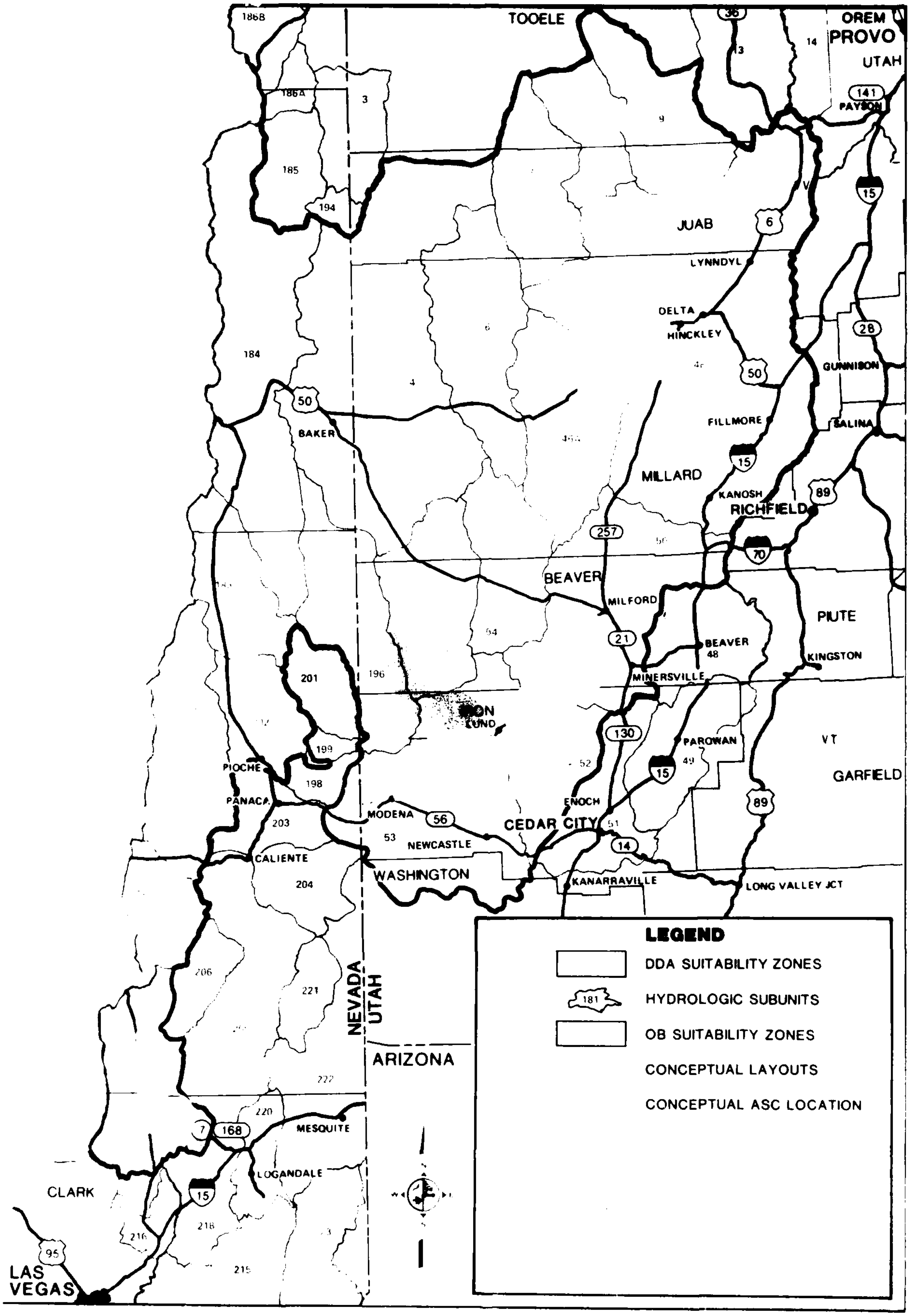

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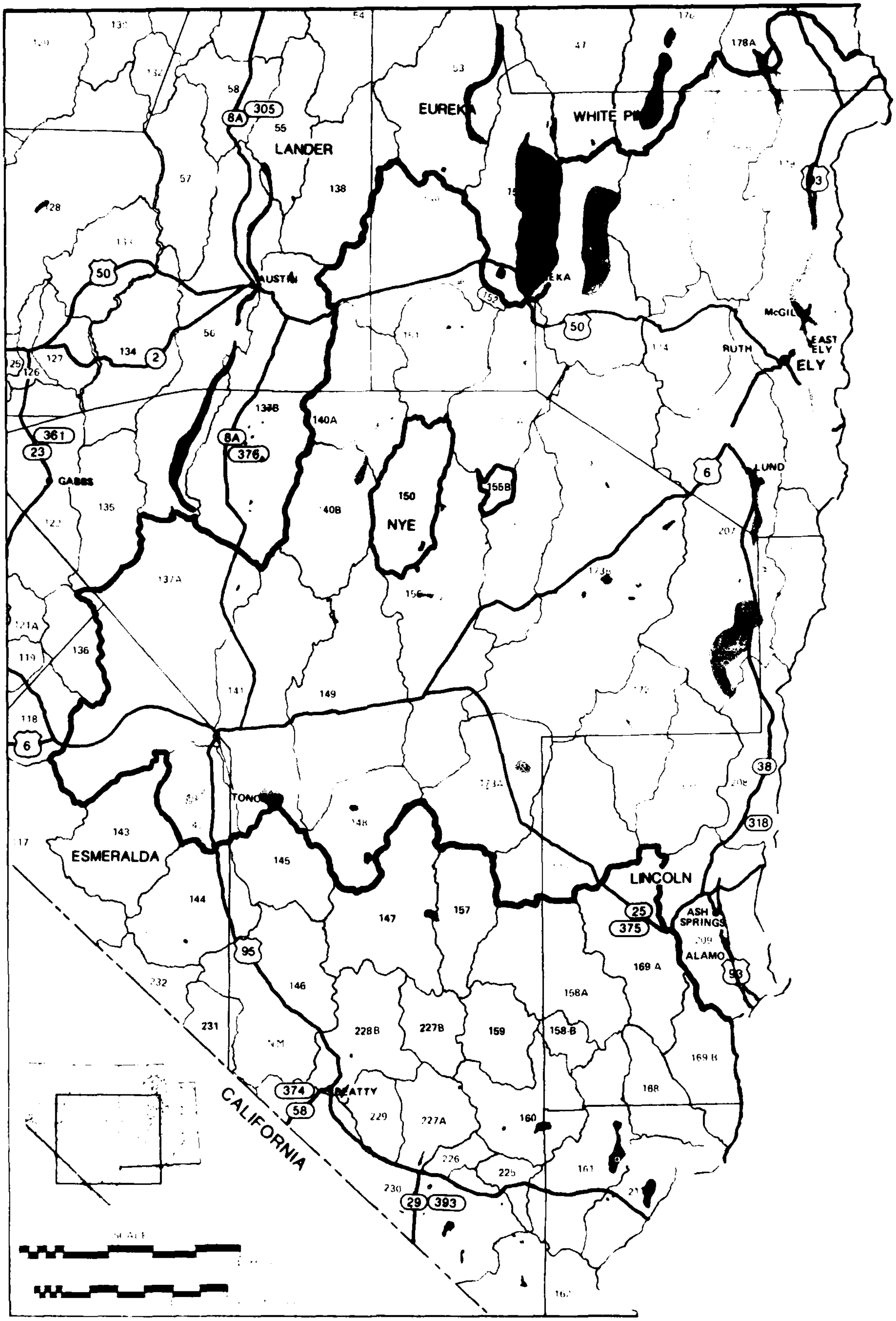
Figure 3.2.2.6-4. Distribution of elk in the Nevada/Utah study area.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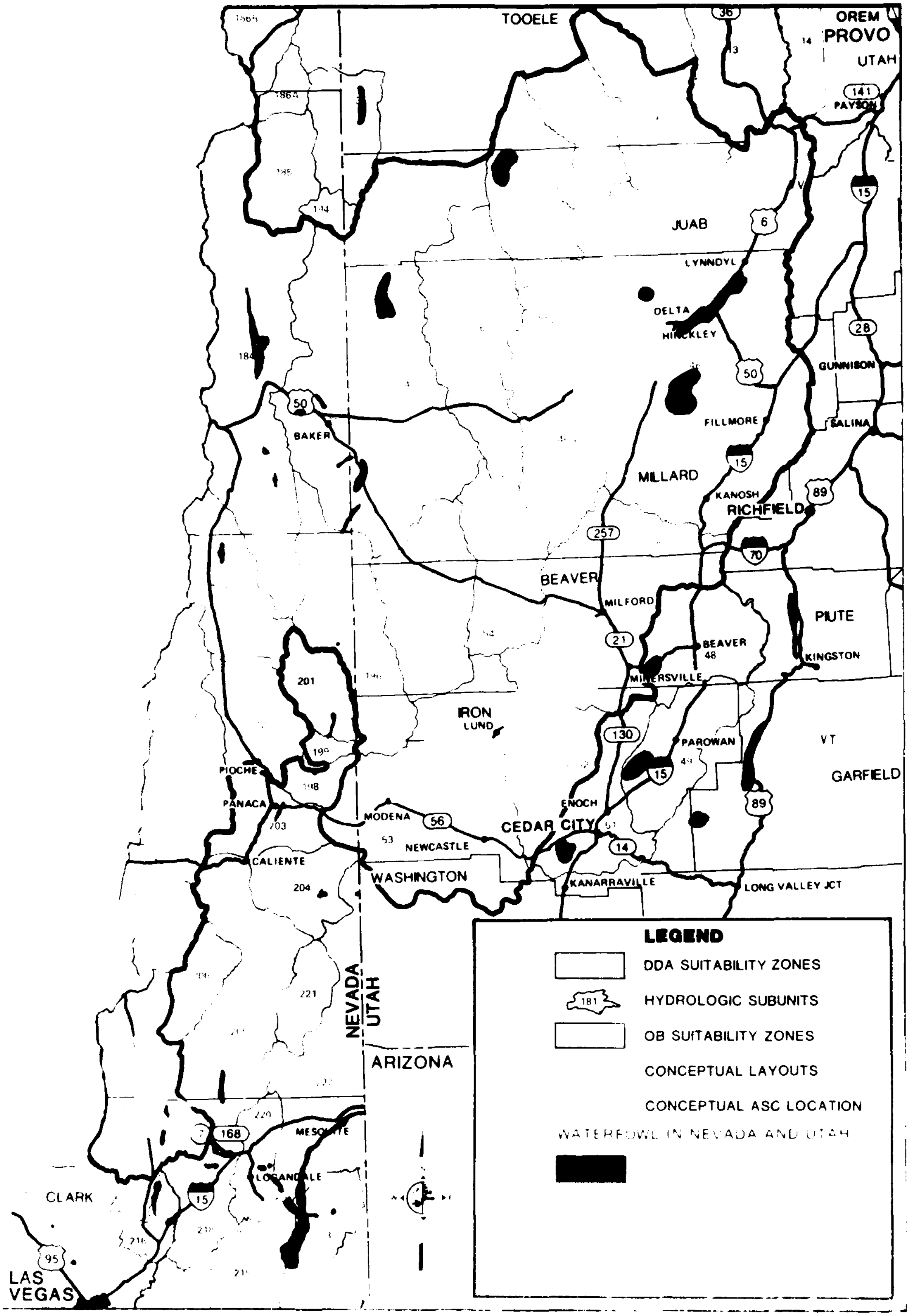
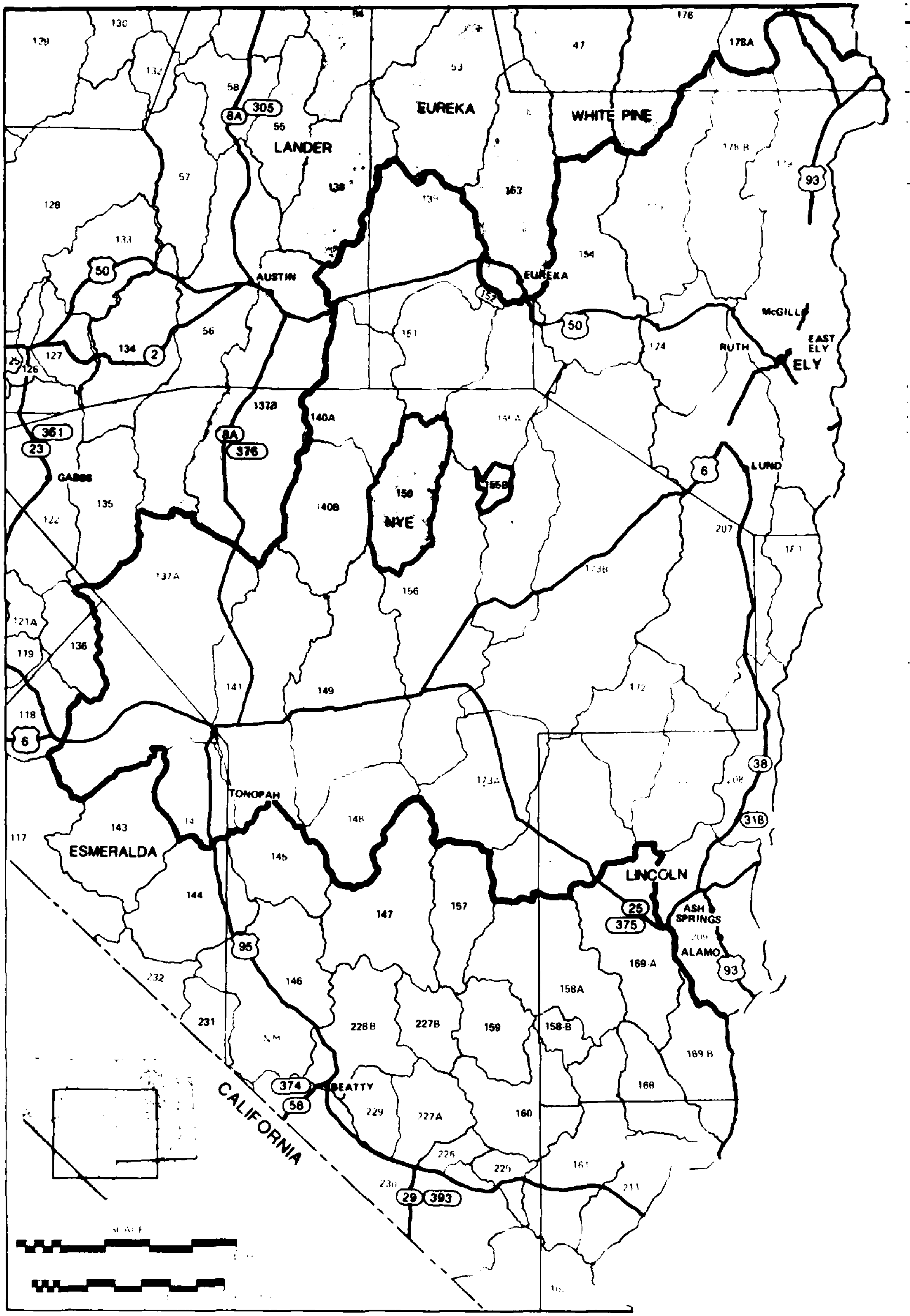


[illegible]gure 3.2.2.6-1. Water[illegible] habita[illegible] in the [illegible] area.



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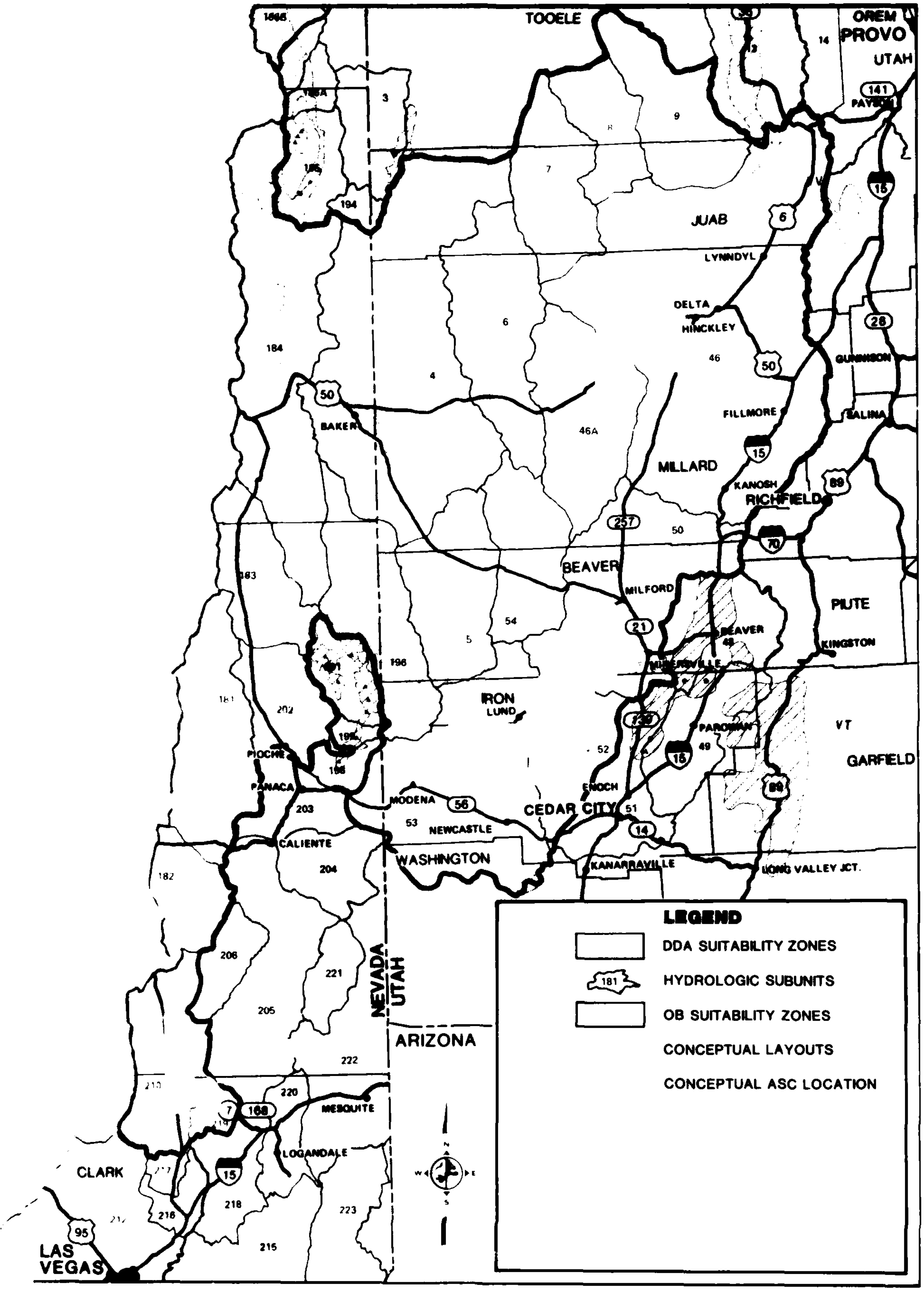
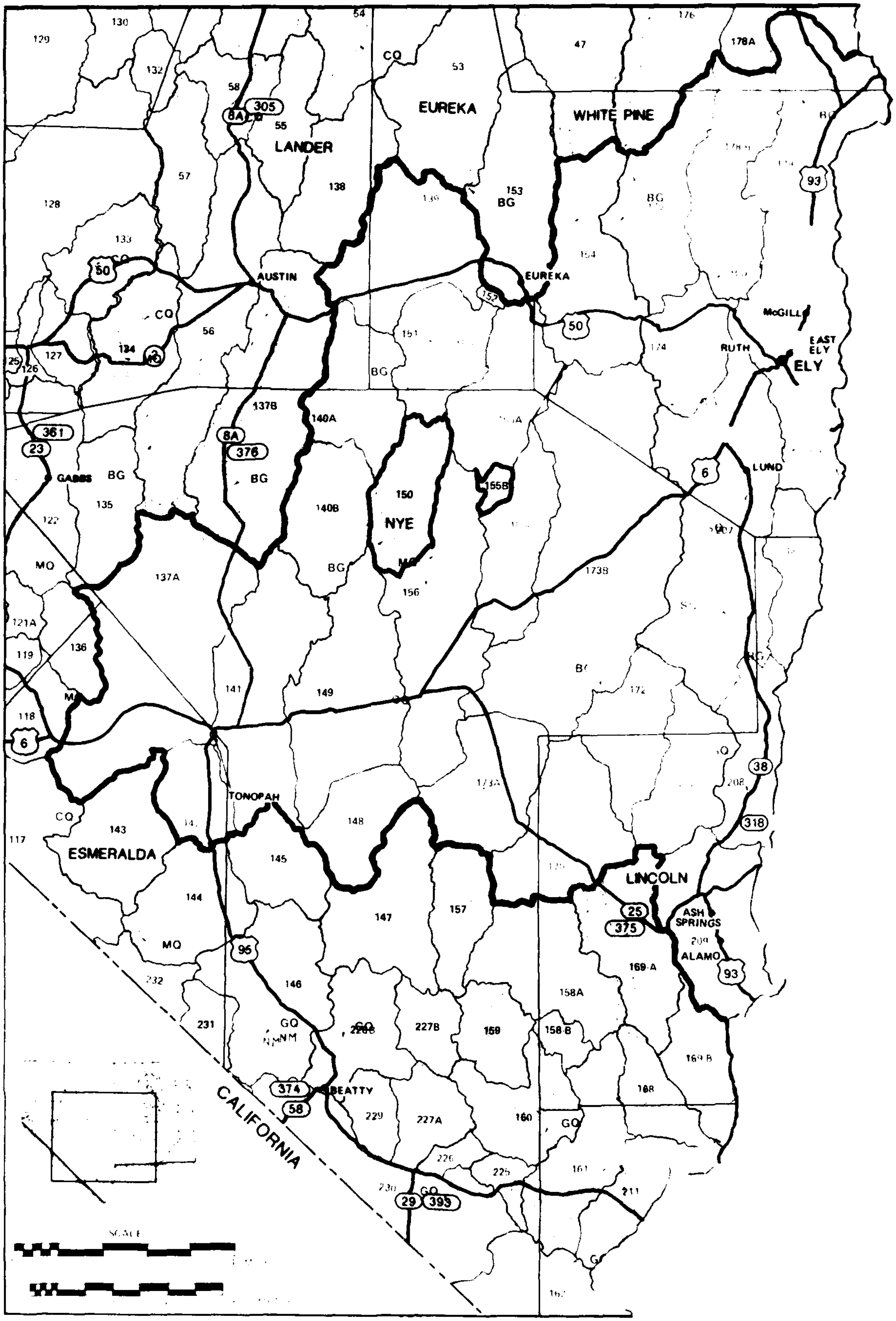


Figure 3.2.2.6-6. Sage grouse range and wintering grounds in the Nevada/Utah study area.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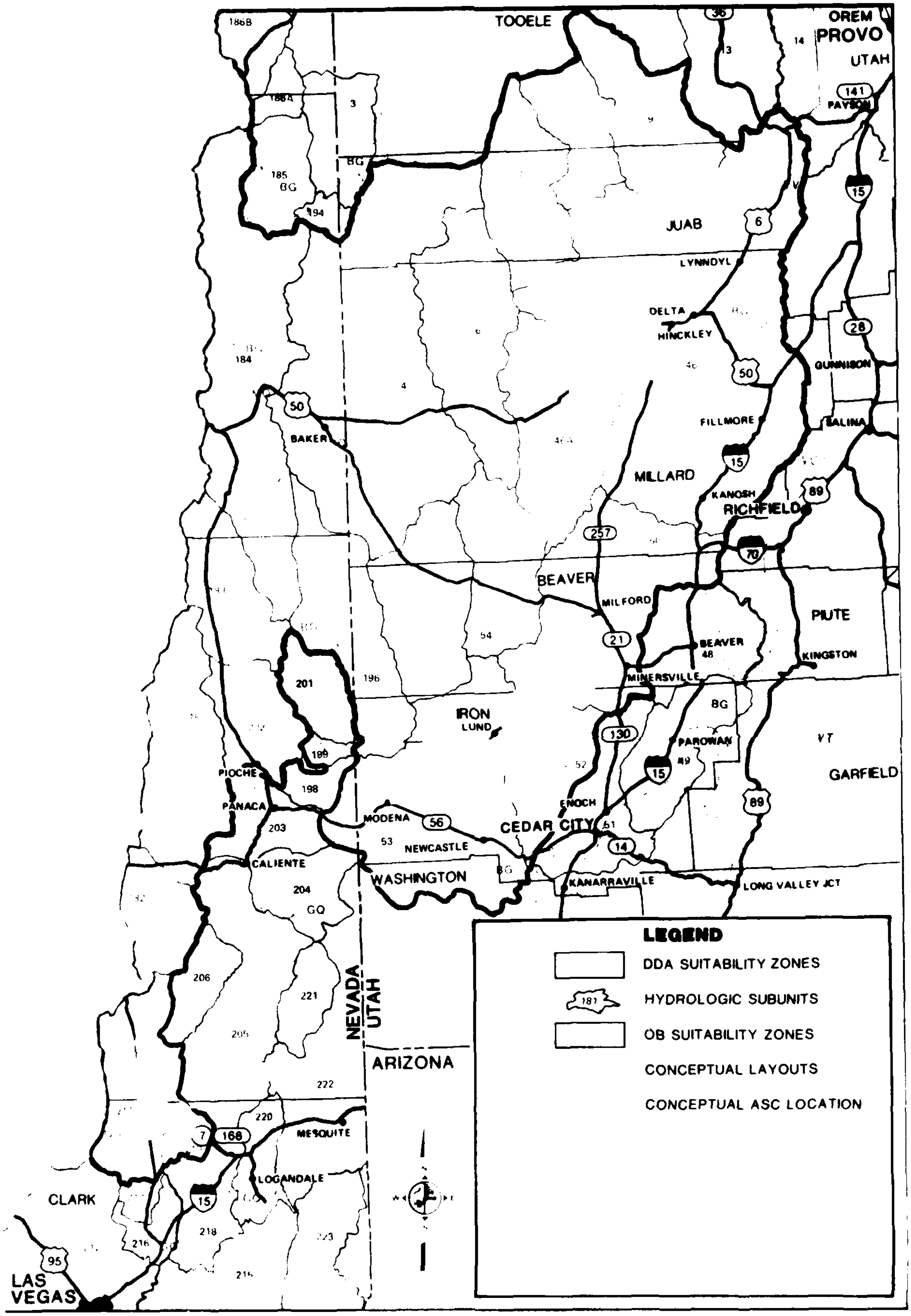
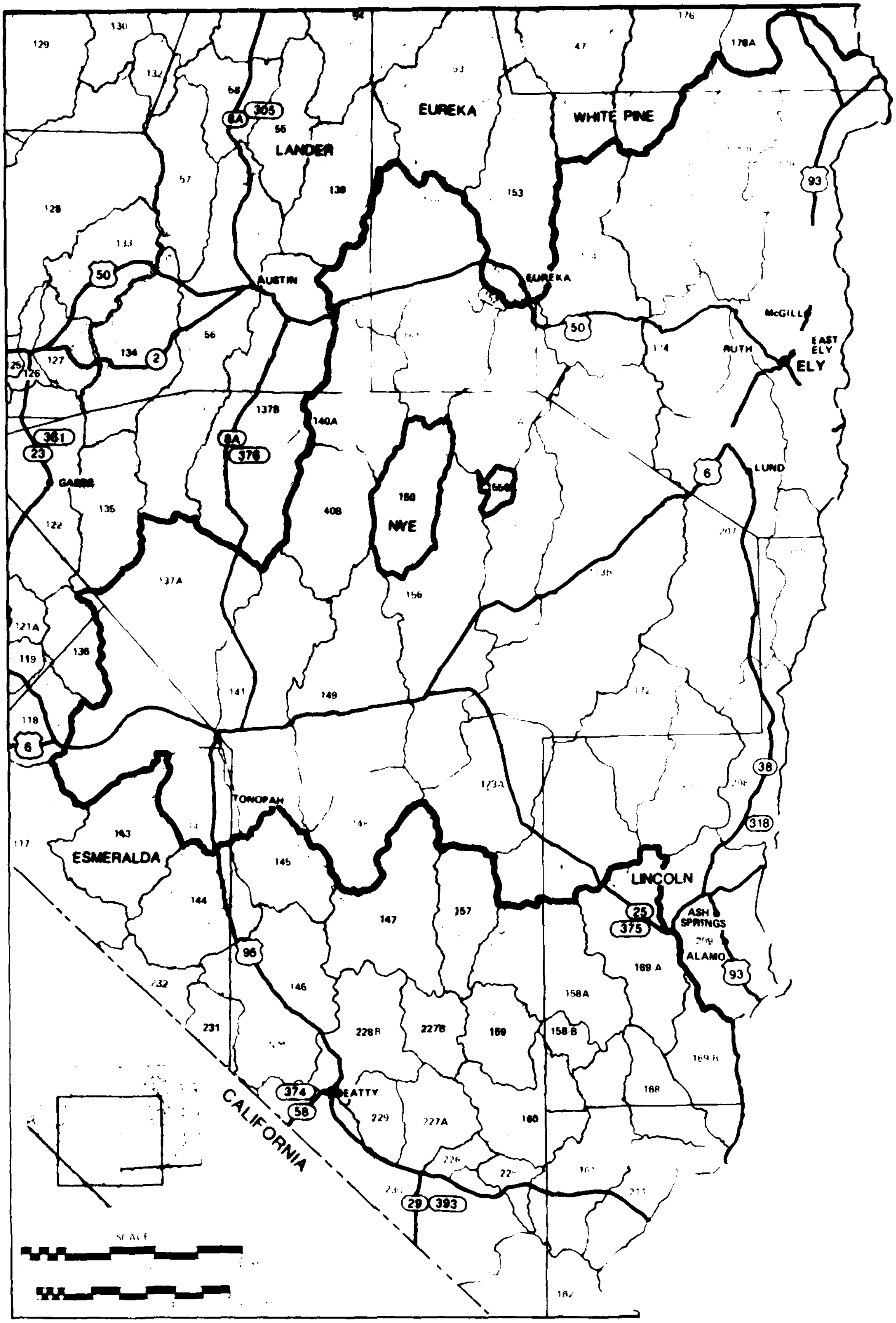


Figure 3.2.2.6-7. Distribution of the grouse and quail in the Nevada/Utah study area.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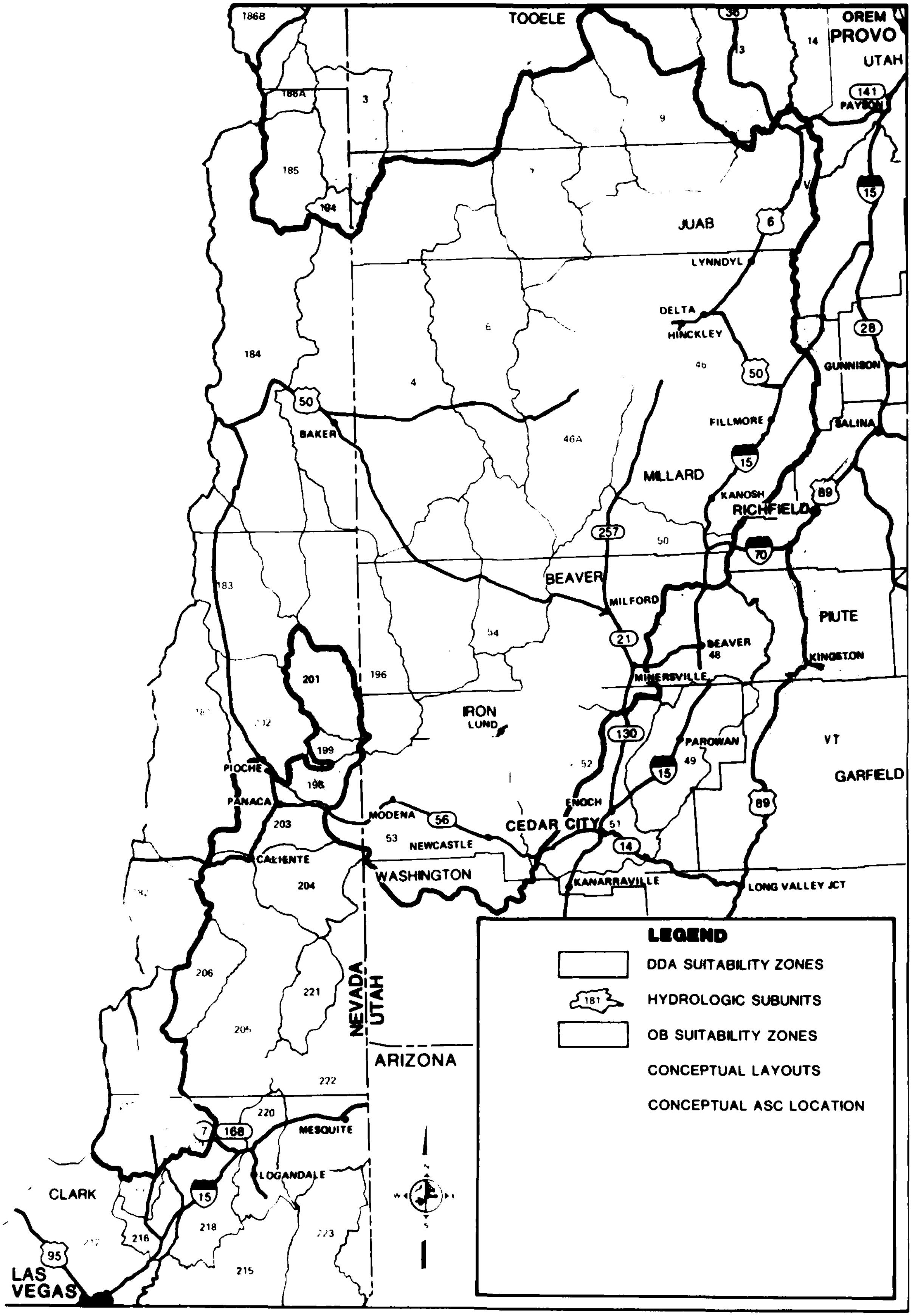

Figure 3.2.2.6-8. Chukar partridge distribution in the Nevada/Utah study area.

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Aquatic Species (3.2.2.7)

Aquatic Habitat (3.2.2.7.1)

The intermittent nature and salinity/alkalinity of most streams and playas limits the development of aquatic life. Playas may support short-lived populations of brine shrimp, algae, and zooplankton. Birds may feed on these when abundant. The perennial habitats include small springs, streams, and a few reservoirs and ponds (Figure 3.2.2.7-1). Some isolated spring habitats are, however, subject to drying due to nearby water table lowering.

Aquatic Biota (3.2.2.7.2)

Mountain streams and cold water springs provide habitat for fish, particularly trout (Table 3.2.2.7-1). Reservoirs and ponds are usually stocked with trout and pike and warm-water fish such as bass, sunfish, and catfish. A great variety of endemic fish (many of which are protected) inhabit isolated springs and streams that were left when Pleistocene lakes dried up.

Protected Species (3.2.2.8)

Numerous unique and rare species of plants, aquatic species, and wildlife reside within or pass through the project area. Many are protected by the Endangered Species Act (ESA) of 1973, as amended in 1978.

The policy underlying the ESA is to further the conservation of endangered and threatened species. "Endangered species" are those in danger of extinction; "threatened species" are those likely to become "endangered" in the foreseeable future. The act applies to fish, wildlife, and plants.

The Department of the Interior first determines what species are endangered or threatened and publishes a list. The key portion of the Act is then Section 7, which requires all federal agencies to ensure that the actions they authorize, fund, or implement will not jeopardize the continued existence of endangered or threatened species or modify their critical habitats.

Under subsection (a) of that section, each agency must consult with the Secretary of the Interior to ascertain, after consultation with the affected state also, the impact of its Proposed Action on any endangered or threatened species. Subsection (b) requires this consultation process be concluded within 90 days after its initiation or within a time span mutually agreeable to the Secretary and the federal agency involved.

After the conclusion of the consultation, the Secretary must issue a written statement to the federal agency setting forth his opinion on how the proposed agency action would affect the species, and he must suggest reasonable and prudent alternatives which would avoid jeopardizing its continued existence.

By amendments enacted in 1978, Congress established a procedure for allowing certain projects to proceed despite the strict prohibitions of Section 7. The procedures were adopted in response to the Supreme Court's decision halting the Tellico Dam project, where the snail darter's existence was found to be jeopardized.

A special act of Congress in 1979 was required to provide an exemption to permit completion of the Tellico Dam.

The amendments created an Endangered Species Committee, composed of selected Cabinet Members and senior government officials, and empowered it to grant exemptions according to statutory guidelines "if there are no reasonable and prudent alternatives," and if the action is "in the public interest." Also, subsection (j) of Section 7 provides a Department of Defense exemption as follows:

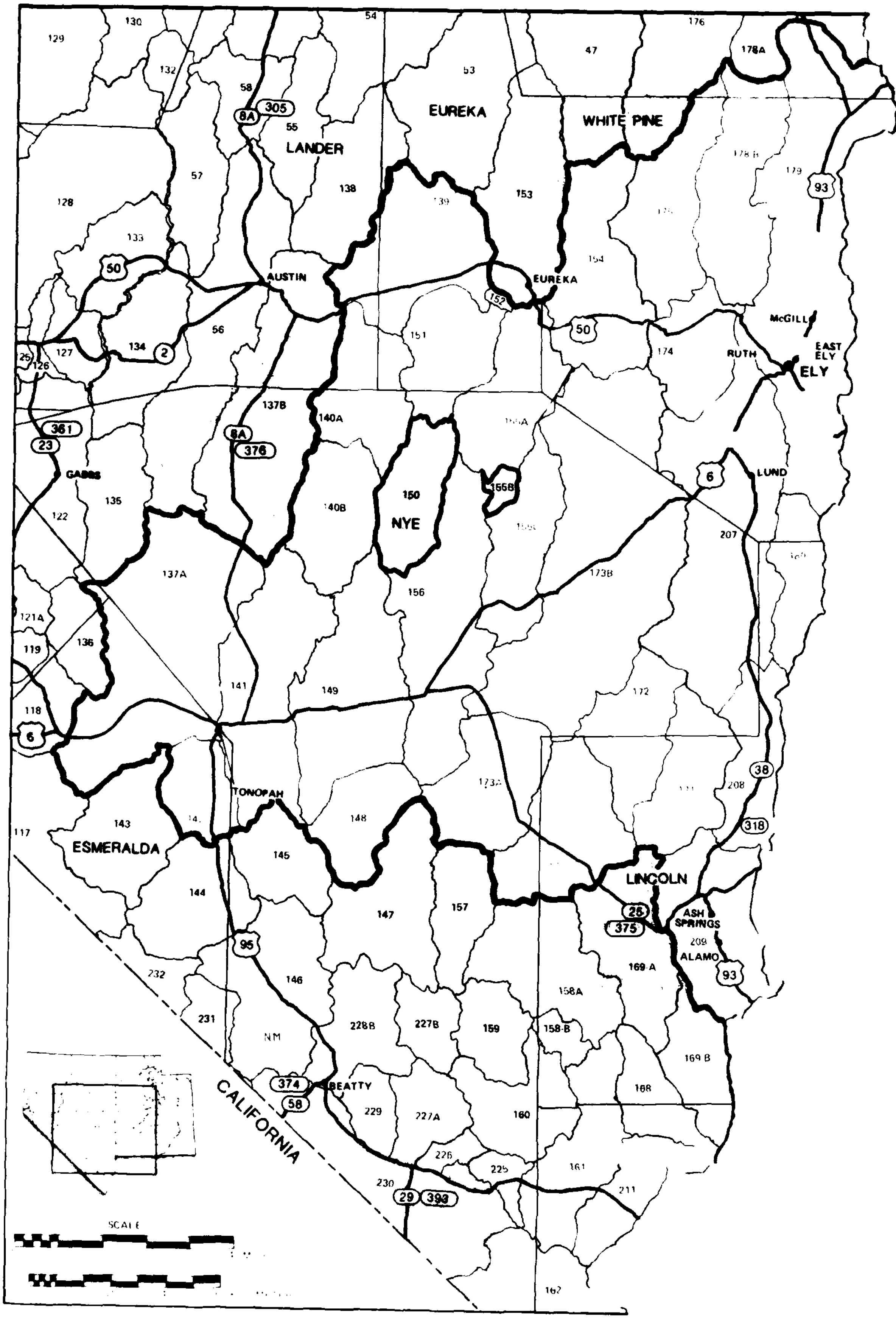
> Notwithstanding any other provision of this Act, the (Endangered Species) Committee shall grant an exemption for any agency action if the Secretary of Defense finds that such exemption is necessary for reasons of national security.

Each state selects species for protection based upon criteria provided by local experts. These listings tend to correlate well with federal and other states classifications, even though minor inconsistencies are common. Classification differences relate primarily to variations in species occurrence and abundance in each state and the opinions of local decisionmakers. Since the terminology between states and the federal government often differ, terminology regarding levels of protection has been standardized for this report. For purposes of this report the term "protected species" applies to rare, threatened, or endangered species that are candidates for or already included on state or federal lists. Further information is provided in ETR-17, "Protected Species."

Plant Species (3.2.2.8.1)

Numerous species of rare plants in Nevada and western Utah are being considered for protection under federal and state endangered species legislation. Several species in Utah have already been federally listed for protection under the Endangered Species Act of 1973. Three of these endangered species, the purple-spined hedgehog cactus (Echinocereus engelmanii var. purpureus), the Siler pincushion cactus (Pediocactus sileri), and the dwarf bear poppy (Arctomecon humilis), occur in southwestern Utah near, but outside, the project area. The Osgood Mountains milkvetch (Astragalus yoder-williamsii), which occurs outside the project area in Humboldt County, Nevada, was emergency listed on August 13, 1980 (45 FR 53968-53970) for a period of 240 days. As of April 15, 1981, the emergency determination is no longer in effect. These species border the project area: there are no federally listed threatened or endangered species known to occur within M-X project area.

Eighteen critically endangered rare plant species in Nevada have been listed for protection by the Nevada Forestry Division under NRS 527.270 (Nevada Revised Statutes). They are:



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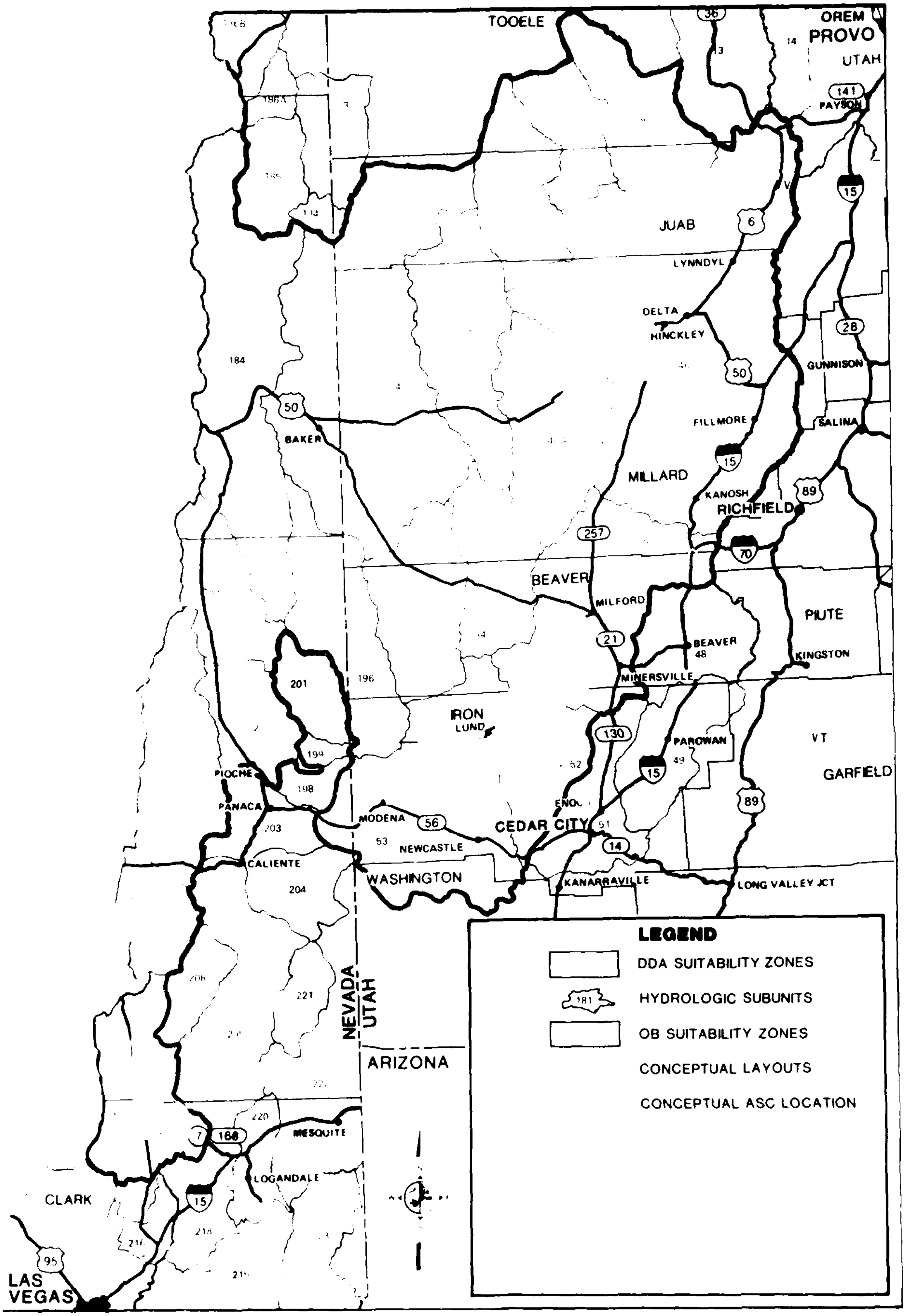

Figure 3.2.2.7-1. Major wetlands and riparian habitat, protected, and recommended protected aquatic species in the Nevada/Utah study area.

LEGEND

PROTECTED FISH SPECIES FOR NEVADA AND AND UTAH

A ASH MEADOWS AMARGOSA PUPFISH
B CUI UI*
E RAILROAD VALLEY SPRINGFISH
G WARM SPRINGS AMARGOSA PUPFISH*
H DEVIL'S HOLE PUPFISH*
I BIG SPRING SPINEDACE
J WHITE RIVER SPINEDACE
K WHITE RIVER DESERT SUCKER
L WHITE RIVER SPRINGFISH
M PAHRANAGAT ROUNDTAIL CHUB*
N PAHRUMP KILLIFISH*
O MOAPA DACE*
P LAHONTAN CUTTHROAT TROUT*
Q LEAST CHUB
R VIRGIN SPINEDACE
S VIRGIN RIVER ROUNDTAIL CHUB
T WOUNDFIN*

RECOMMENDED PROTECTED FISH SPECIES FOR NEVADA AND UTAH

1 PRESTON WHITE RIVER SPRINGFISH
2 MORMON WHITE RIVER SPRINGFISH
3 WHITE RIVER SPRINGFISH
3a HIKO WHITE RIVER SPRINGFISH
3b MOAPA WHITE RIVER SPRINGFISH
4 ASH MEADOWS SPECKLED DACE
5 INDEPENDENCE VALLEY SPECKLED DACE
6 CLOVER VALLEY SPECKLED DACE
7 MOAPA SPECKLED DACE
8 NEWARK VALLEY TUI CHUB
9 LAHONTAN TUI CHUB
11 INDEPENDENCE VALLEY TUI CHUB
13 FISH SPRINGS TUI CHUB
14 JUNE SUCKER
16 UTAH LAKE SCULPIN
18 WHITE RIVER SPECKLED DACE
C RELICT DACE
F BONNEVILLE CUTTHROAT TROUT
(R) VIRGIN SPINEDACE

RECOMMENDED PROTECTED INVERTEBRATES

MOLLUSCS

19 OVERTON ASSIMINEA
20 MOAPA VALLEY TURBAN
21 ASH MEADOWS TURBAN
22 PAHRANAGAT VALLEY TURBAN
23 HOT CREEK TURBAN
24 STEPTOE TURBAN
25 WHITE RIVER VALLEY FONTELICELLA
26 RUBY VALLEY FONTELICELLA
27 CURRENT FONTELICELLA
28 DUCKWATER FONTELICELLA
29 RED ROCK FONTELICELLA
30 WHITE RIVER VALLEY HYDROBID
31 DUCKWATER SNAIL
32 CORN CREEK SNAIL
33 ASH MEADOWS TRYONIA
34 MOAPA TRYONIA
35 ZION CANYON PHYSA
36 RUSSELL'S SNAIL

INSECTS

DIPTERANS:
37 VIRGIN RIVER NET WINGED MIDGE
HEMIPTERANS:
38 ASH SPRINGS CREEPING WATER BUG
39 MOAPA CREEPING WATER BUG
PLECOPTERANS:
40 GIANT STONEFLY NYMPH

MAJOR WETLANDS AND RIPARIAN HABITAT

WATER BODY
WATER COURSE WITH FLOW DIRECTION INDICATED
INTERMITTENT WATER COURSE
INTERMITTENT WATER BODY
MARSH
SPRING
WMA WILDLIFE MANAGEMENT AREA

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Table 3.2.2.7-1. Fish of Nevada/Utah which may be affected by the M-X Project. Species classified as game fish in Nevada or Utah are so indicated (Page 1 of 4).

Species Name	Common Name
Family CLUPEIDAE	Shad and Herring
Dorosoma petenense atchafalayae	Mississippi threadfin shad
Family SALMONIDAE	Salmon, Trout, Grayling, and Whitefish
Oncorhynchus tshawythscha	Chinook salmon[1]
O. nerka kennalyi	Sockeye (kokanee) red salmon[1,2]
Salvenlinus namaycush	Lake trout[1,2]
S. fontinalis	Brook trout[1,2]
S. confluentus	Bull trout[1]
Salmo clarki	Cutthroat trout
S. c. henshawi	Lahontan cutthroat trout[3]
S. c. pleuriticus	Colorado cutthroat trout[1,2]
S. c. utah	Bonneville cutthroat trout[1,2]
S. c. lewisi	Yellowstone cutthroat trout[1,2]
S. c. gairdnari	Rainbow trout[1,2]
S. g. irideus	Southcoast rainbow trout[1]
S. g. kamloops	Kamloops rainbow trout[1]
S. aquabonita	Golden trout[1,2]
S. trutta	Brown trout[2]
Thymallus arcticus	Arctic grayling[2]
Prosopium williamsoni	Mountain whitefish[1,2]
P. gemmiferum	Bonneville cisco[2]
P. spilonotus	Bonneville whitefish[2]
P. abyssicola	Bear Lake whitefish[2]
Family ESOCIDAE	Pike
Esox lucius	Northern pike[2]
Family CATOSTOMIDAE	Suckers
Catostornus platyrhynchus	Mountainsucker
C. clarki	Desert sucker
C. discobolus	Bluehead sucker
C. marcocheilus	Largescale sucker
C. columbianus	Bridgelip sucker
C. ardens	Utah sucker
C. latipinnis	Flannelmouth sucker
C. tahoensis	Tahoe sucker

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Table 3.2.2.7-1. Fish of Nevada/Utah which may be affected by the M-X Project. Species classified as game fish in Nevada or Utah are so indicated (Page 2 of 4).

Species Name	Common Name
Family CATOSTOMIDAE (continued)	Suckers (continued)
Catostomus clarki intermedius	White River desert sucker
C. fecundus	Webug sucker
C. commersoni	White sucker
Chasmistes cujus	Cui-ui
C. liorus	June sucker
Xyrauchen texanus	Razorback sucker
Family CYPRINIDAE	Carp and Minnows
Ptychocheilus oregonesis	Northern squawfish
P. lucius	Colorado squawfish
Acrocheilus alutaceus	Chiselmouth
Gila robusta jordani	Pahranagat roundtail chub
G. r. seminuda	Virgin River roundtail chub
G. r. ssp.	Moapa River roundtail
G. atraria	Utah chub
G. bicolor euchila	Fish Creek Springs tui chub
G. b. isolata	Independence Valley tui chub
G. b. newarkensis	Newark Valley tui chub
G. b. obesa	Lahontan tui chub
G. b. ssp.	Railroad Valley tui chub
G. b. ssp.	Big Smoky Valley tui chub
G. cypha	Humpback chub
G. elegans	Bonytail
G. copei	Leatherside chub
Iotichthys phlegethontis	Least chub
Richardsonius ergregius	Lahontan redshiner
R. balteatus	Redside shiner
Notemigonus crysoleucas	Golden shiner
Notropis lutrensis	Red shiner
N. stramineus	Sand shiner
Rhinichthys. osculus. robustus	Lahontan speckled dace
R. o. lethoporus	Independence Valley speckled dace
R. o. nevadensis	Nevada speckled dace
R. o. oligoporus	Clover Valley speckled dace
R. o. moapae	Moapa speckled dace
R. o. carringtoni	Snake Valley speckled dace

T1425/9-20-81/F

Table 3.2.2.7-1. Fish of Nevada/Utah which may be affected by the M-X Project. Species classified as game fish in Nevada or Utah are so indicated (Page 3 of 4).

Species Name	Common Name
Family CYPRINIDAE (continued)	Carp and Minnows (continued)
Rhinichthys osculus velifer	White River speckled dace
R. o. yarrowi	Virgin River speckled dace
R. o. ssp.	Meadow Valley Wash speckled dace
R. o. sp.	Bonneville speckled dace
R. cataractae	Longnose dace
Moapa coriacea	Moapa dace
Eremichthys acros	Desert dace
Relictus solitarius	Relict dace
Cyprinus carpio	Common carp
Carassius auratus	Goldfish
Orthodon microlepidotus	Sacramento blackfish
Lepidomedia albivallis	White River spinedace
L. mollispinis mollispinis	Virgin spinedace
L. m. pratensis	Big Spring spinedace
Plagopterus argentissimus	Woundfin
Pimephales promelas	Fathead minnow
P. vigilax	Bullhead minnow
Family ICTALURIDAE	North American Catfish
Ictalurus punctatus	Channel catfish[1,2]
I. catus	White catfish[1]
I. nebulosus	Brown bullhead[1]
I. melas	Black bullhead[1,2]
I. natalis	Yellow bullhead[2]
Pylodictis olivaris	Flathead catfish[2]
Family CYPRINODONTIADE	Killifish
Cyprinodon nevadensis	Amargosa pupfish
C. n. pectoralis	Warm Springs pupfish
C. n. mionectes	Ash Meadows pupfish
C. diabolis	Devils Hole pupfish
Crenichthys baileyi baileyi	White River springfish
C. b. moapae	Moapa White River springfish
C. b. grandis	Hiko White River springfish
C. b. albivallis	Preston White River springfish
C. b. thermophilus	Moormon White River springfish
C. nevadae	Railroad Valley springfish
Empetrichthys latos latos	Pahrump killifish

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Table 3.2.2.7-1. Fish of Nevada/Utah which may be affected by the M-X Project. Species classified as game fish in Nevada or Utah are so indicated (Page 4 of 4).

Species Name	Common Name
Family CYPRINODONTIDAE (continued)	Killifish (continued)
Fundulus kansae	Plains killifish
Family POECILIIDAE	Topminnows
Gambusia affinis	Mosquitofish
Poecilia latipinna	Sailfin molly
P. reticulata	Guppy
Xiphophorus helleri	Green swordtail
X. maculatus	Southern platyfish
Family PERCIDAE	Perch
Perca flavescens	Yellow perch[1,2]
Stizostedion vitreum vitreum	Walleye[1]
Family CENTRARCHIDAE	Sunfish
Archoplites interruptus	Sacramento perch[1,2]
Micropterus salmoides	Largemouth bass[1,2]
M. dolomieui	Smallmouth bass[1,2]
Family PERCICHTHYIDAE	
Morone saxatilis	Striped bass[1,2]
M. chrysops	White bass[1,2]
Lepomis macrochirus	Bluegill[1,2]
L. cyanellus	Green sunfish[1,2]
Pomoxis nigromaculatus	Black crappie[1,2]
P. annularis	White crappie[1,2]
Family COTTIDAE	Sculpins
Cottus beldingi	Paiute sculpin
C. bairdi semiscabei	Bonneville Baird sculpin
C. bairdi punctulatus	Colorado mottled sculpin
C. extensus	Bear Lake sculpin
C. echinatus	Utah Lake sculpin

T1425/9-20-81/F

[1]Game fish in Nevada.

[2]Game fish in Utah.

[3]Federally classified as threatened.

Common Name	Scientific Name
Golden Bear Poppy	Arctomecon californica
*Meadow Valley Range Sandwort	Arenaria stenomeres
Beatley milkvetch	Astragalus beatleyae
*Geyer milkvetch	Astragalus geyeri var. triquetrus
Sodaville milkvetch	Astragalus lentiginosus var. sesquimetralis
*Nye milkvetch	Astragalus nyensis
Ash Meadows milkvetch	Astragalus phoenix
*Monte Neva Indian paintbrush	Castilleja salsuginosa
Las Vegas Cryptantha	Cryptantha insolita
*Silver-leaf buckwheat	Eriogonum argophyllum
Lemmon buckwheat	Eriogonum lemmonii
*Sticky buckwheat	Eriogonum viscidulum
*Sunnyside green gentian	Frasera gypsicola
Mojave Sweet Pea	Lathyrus hitchcockianus
Ash Meadows Blazing Star	Mentzelia leucophylla
Buried Hills Penstemon	Penstemon thurberi var. anestius
Inconspicuous Phacelia	Phacelia inconspicua
*Ruby Mountain Primrose	Primula capillaris.

The distributions of these species were analyzed and those known to occur within the project area were mapped (see ETR-17, Protected Species, Appendices A-1, and A-3). The state-protected species mapped are indicated by an asterisk (*) above. In addition to these critically endangered species, all species of the family Cactaceae, the genus Yucca, and all evergreen trees are protected under NRS 527.050 and NRS 527.070 (Nevada Revised Statutes, 1977, amended 1979). Utah has no state laws which afford protection to rare plants.

Under the Endangered Species Act of 1973, preliminary lists of endangered and threatened plant species were published in the Federal Register in 1975 and 1976. The 1975 list was a notice of review, and species included on it and not subsequently proposed or listed were generally referred to as "candidate" threatened or endangered species. Species included on the 1976 list of 1,700 proposed endangered species were generally referred to as "proposed" species. Both lists were screened to identify those species known to occur in or near the initial M-X study area in Nevada/Utah; over 200 were identified. On 15 December 1980, the U.S. Fish and Wildlife Service (USFWS) published an updated, nationwide Notice of Review of Plant Taxa. It is now the current document regarding the status of plant species. Included in it are three tables, one containing plant taxa currently listed by the USFWS as either threatened or endangered, another containing plant taxa proposed for listing as threatened or endangered. No species listed in either table are known to occur within the M-X project area. The third and longest table contains plant taxa currently under review by USFWS, and is divided into three categories in order to accurately reflect the Service's evaluation of the species' status. Category one (1) taxa are those for which the USFWS presently has sufficient information on hand to support their being listed as endangered or threatened species. Category two (2) taxa are those for which the FWS presently has some information on hand to support their being listed as endangered or threatened species, but for which more

information is needed. The fourth table contains taxa no longer under review. Category three (3) taxa are no longer being considered for listing as endangered or threatened, either because there is persuasive evidence of their extinction, or because the names do not represent taxa meeting the Endangered Species Act definition of "species", or because they have proven to be more abundant or widespread than was previously believed. Also included in category (3) were taxa not subject to any identifiable threat. The USFWS considers plants of categories (1) and (2) to be candidates for addition to the current list of endangered and threatened plants, and thus recommends that they be considered in environmental planning.

As the area required for M-X construction decreased, so did the number of species potentially affected. There are 74 plant species in categories (1) and (2) known to occur within current Nevada/Utah M-X project area (see Table 3.2.2.8-4 for a listing). Known locations of these species have been mapped as accurately as possible, using data which were available from the literature and from surveys conducted during the field season of 1980 (see ETR-17, Protected Species, Appendices A-1 and A-3).

Figure 3.2.2.8-1 shows where federal candidate rare plant species are concentrated in M-X project area. For specific detail, refer to Appendix A-3, ETR-17. The system layouts for full and split basing in Nevada/Utah are shown in Chapter 4. Appendix A-1 to ETR-17 lists the species known to occur in the project area and gives a summary of the distribution and habitat information available. Table 3.2.2.8-1 lists the preferred habitat of a representative sample of rare and endangered plant species in the study area. Currently, rare plants are being reviewed on a case-by-case basis by federal and state authorities, and many species may be elevated to formal protection under state or federal laws prior to the commencement of M-X construction. Informal consultation with the USFWS, required by Section 7 of the Endangered Species Act, has begun, and written communications have been received from the lead office of the USFWS on various dates between 6 June 1980 and 19 February 1981. Rare plant species of concern to this agency are listed in this FEIS, for both the Nevada/Utah project area (Table 3.2.2.8-2) and the Texas/New Mexico area (see Section 3.3.2.8).

Some of these rare plant species are currently being studied by specialists, and as field data are obtained, individual reports are scheduled to be written on a species-by-species basis. These reports will summarize population and habitat information for each species and will discuss their ranges and the potential effect of M-X on them.

There is a dearth of information on the ecological status and distribution of many rare plants in Nevada and Utah. For this analysis, fairly complete literature and herbaria searches have been conducted, and emphasis has been concentrated on summarizing these data, and on analyzing the comprehensive field inventories that were undertaken by local experts during the growing season of 1980. The purpose of these inventories, which concentrated on 11 valleys within the project area (see Figure 3.2.2.8-2), was three-fold:

(1) to evaluate the current status of the species of concern at locations where they had been previously reported;

(2) to locate new populations of rare species by selective and discriminate search of appropriate or likely habitat;

Table 3.2.2.8-1. Selected rare plants categorized by environment (Page 1 of 2).

Species which occur near thermal springs, seeps

Castilleja salsuginosa
Centaurium namophilum
Eriogonum argophyllum

Species which occur in sandy washes and on flats-Mojave Desert Region

Astragalus geyeri var. triquetrus
A. nyensis
Penstemon fructiciformis var. amargosae
Phacelia anelsonii

Species which occur on sand dunes and deep sandy soils

Astragalus callithrix
A. lentiginosus var. micans
A. pseudiodanthus
Cymopterus ripleyi
Eriogonum ammophilum
E. concinnum
Helianthus deserticolus
Penstemon arenarius
Thelypodium laxiflorum

Species which occur on limestone, Sevy dolomite, or gypsum (valley floors)

Arabis shockleyi
Asclepias eastwoodiana
Astragalus pterocarpus
A. uncialis
Coryphantha vivipara
Cryptantha compacta
Eriogonum eremicum
E. nummulare
E. rubricaule
Frasera gypsicola
Lepidium nanum
Phacelia parishii
Polygala subspinosa var. heterorhyncha
Sclerocactus polyancistrus
S. pubispinus

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Table 3.2.2.8-1. Selected rare plants categorized by environment (Page 2 of 2).

Species which occur on outcrops, ridges, and cliffs

- _Agave utahensis_ var. _eborispina_
- _Arctomecon merriamii_
- _Arenaria stenomeres_
- _Gilia ripleyi_

Species known from bajadas of limestone mountains, with sagebrush, pinyon pines or junipers

- _Astragalus calycosus_ var. _monophyllidius_
- _A. convallarius_ var. _finitimus_
- _A. oophorus_ var. _lonchocalyx_
- _Coryphantha vivipara_ var. _rosea_
- _Cryptantha hoffmanii_
- _C. interrupta_
- _Eriogonum darrovii_
- _E. nummulare_
- _Hulsea vestita_ var. _inyoensis_
- _Lupinus holmgrenanus_

Species known from Sevy dolomite in pinyon-juniper woodland (Pine, Hamlin, Wah Wah valleys)

- _Cryptantha compacta_
- _Eriogonum eremicum_
- _E. natum_
- _Penstemon concinnus_
- _P. nanus_
- _Sphaeralcea caespitosa_

Species which occur in high elevation mountainous areas

- _Cymopterus goodrichii_
- _Draba arida_
- _Erigeron uncialis conjugans_
- _Lesquerella hitchcockii_
- _Lewisia maguirei_
- _Lomatium ravenii_
- _Mertensia toyabensis_
- _Penstemon_ spp.

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Table 3.2.2.8-2. Plant species recommended for treatment in biological assessment/ Section 7 consultation: Nevada/Utah.

Common Name	Scientific Name
Golden bear poppy	Arctomecon californica
Merriam bear poppy	Arctomecon merriamii
Meadow Valley Range sandwort	Arenaria stenomeres
Eastwood milkweed	Asclepias eastwoodiana
Calloway milkvetch	Astragalus callithrix
Tonopah milkvetch	Astragalus pseudiodanthus
Squalid milkvetch	Astragalus serenoi var. sordescens
Toquima milkvetch	Astragalus toquimanus
Currant milkvetch	Astragalus uncialis
Monte Neva indian paintbrush	Castilleja salsuginosa
Clokey pincushion cactus	Coryphantha vivipara var. rosea
Compact catseye	Cryptantha compacta
Mohave cryptantha	Cryptantha tumulosa
Basalt Spring parsley	Cymopterus basalticus
Sand-loving buckwheat	Eriogonum ammophilum
Silver-leaf buckwheat	Eriogonum argophyllum
Terrace buckwheat	Eriogonum natum
No common name	Eriogonum soredium, sp. nov.
Barrell cactus	Ferocactus acanthodes var. acanthodes
Sunnyside green gentian	Frasera gypsicola
Pahute green gentian	Frasera pahutensis
No common name	Gilia heterostyla, sp. nov.
Nye gilia	Gilia nyensis
Dwarf peppergrass	Lepidium nanum
Ostler peppergrass	Lepidium ostleri
Sand cholla	Opuntia pulchella
Watson oxytheca	Oxytheca watsonii
Dune penstemon	Penstemon arenarius
Barneby's beardtongue	Penstemon barnbyi
Tunnel Springs beardtongue	Penstemon concinnus
Bashful pensemon	Penstemon pudicus
Parish phacelia	Phacelia parishii
Spiny milkwort	Polygala heterorhynca
King indigo bush	Psorothamnus kingii
Mojave fishhook cactus	Sclerocactus polyancistrus
Great Basin fishhook cactus	Sclerocactus pubispinus
Jones globe-mallow	Sphaeralcea caespitosa
Oval leaf thelypody	Thelypodium sagittatum var. ovalifolium
Beatley five-leaf clover	Trifolium andersonii var. beatleyae
Frisco clover	Trifolium andersonii var. friscanum
Sheathed deathcamas	Zigadenus vaginatus

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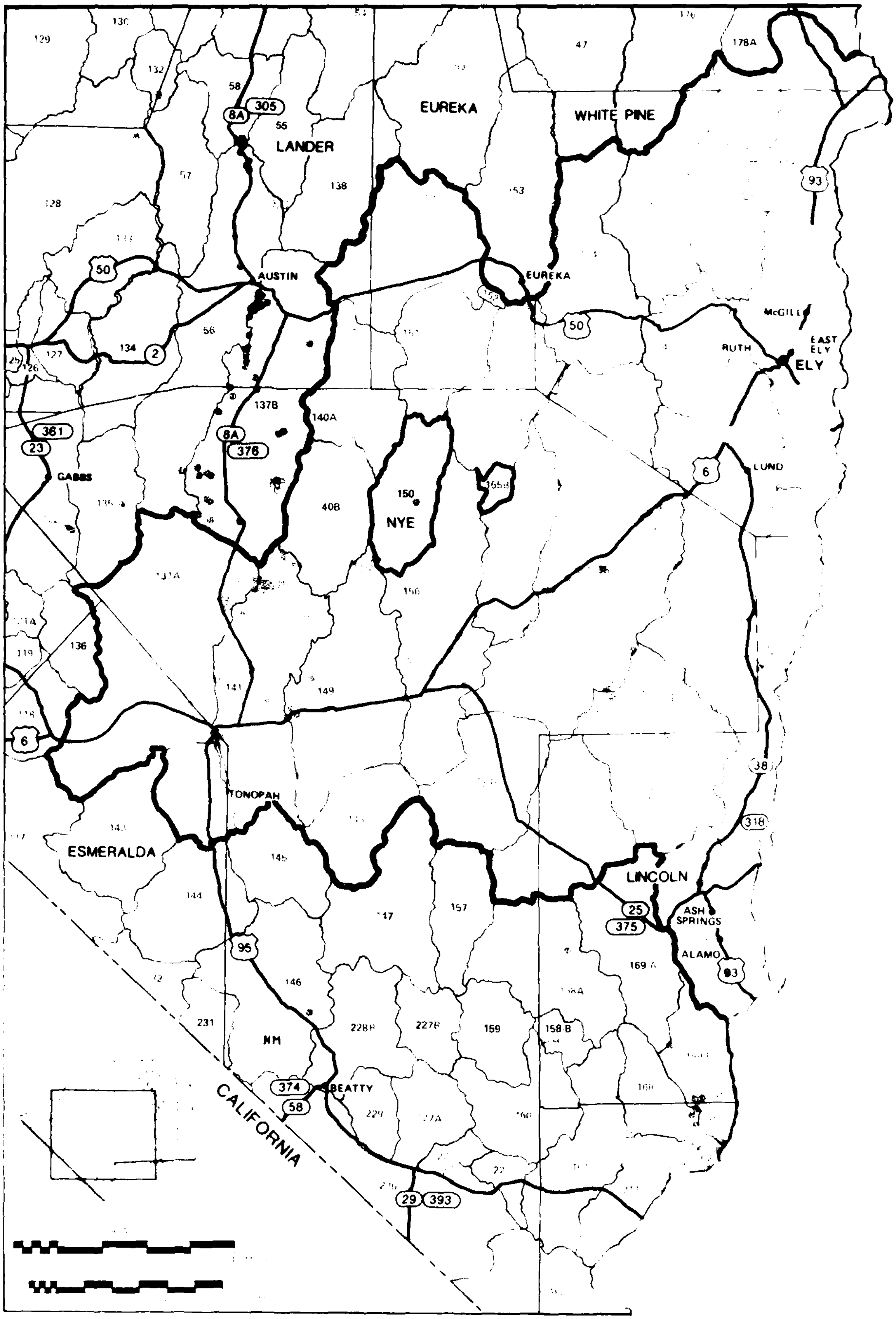
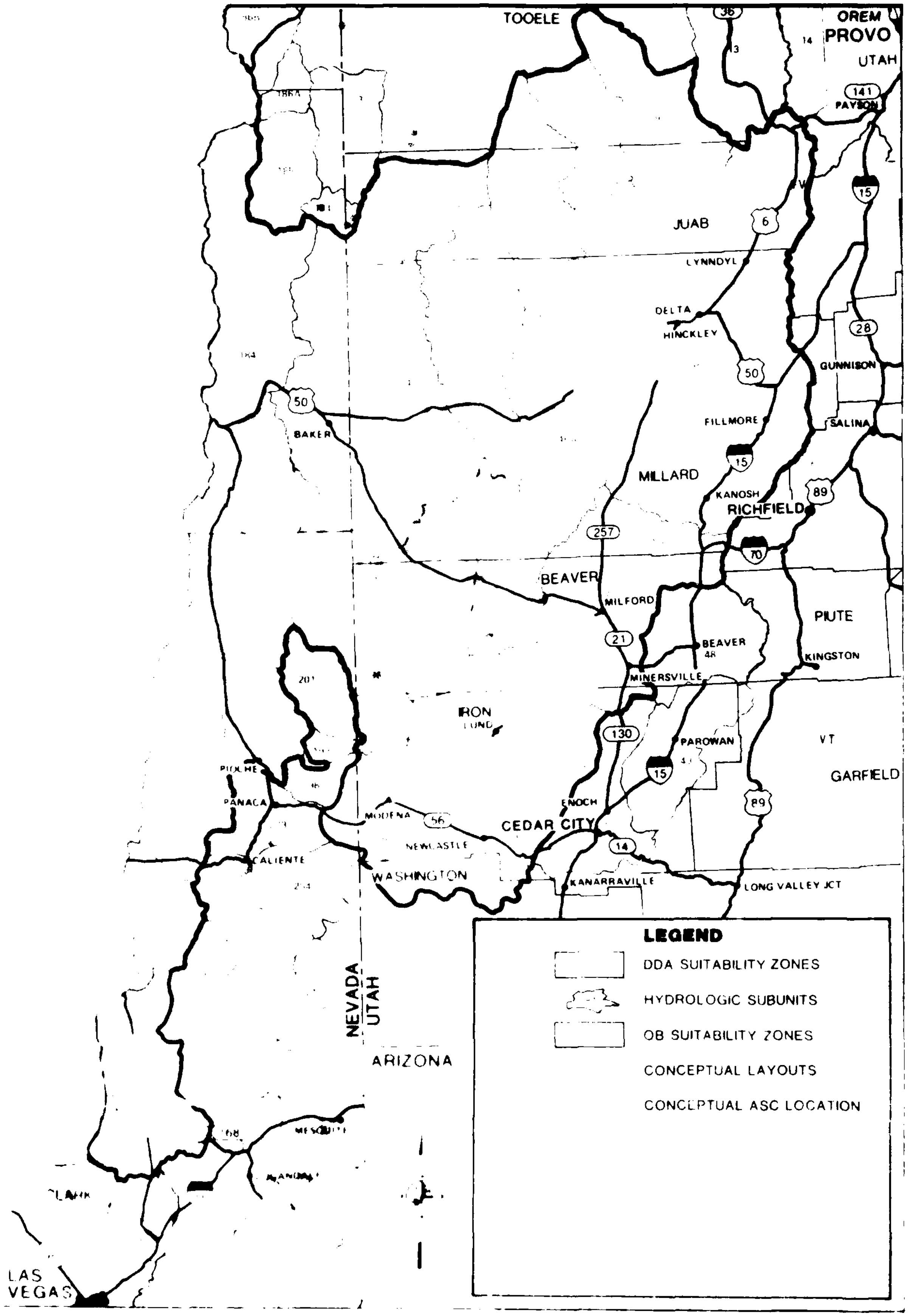
Source: Written Communication to Lt. Col. William Verkest; February 19, 1981. Personal Communication, Section 7 meeting with USFWS; April 16, 1981.


EUREKA
WHITE PINE
LANDER
AUSTIN
EUREKA
McGILL
RUTH
EAST ELY
ELY
GABBS
LUND
NYE
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
ALAMO
BEATTY
CALIFORNIA
50
93
8A
305
2
361
23
376
6
38
318
25
375
95
374
58
29
393



TOOELE
OREM
PROVO
UTAH
PAYSON
JUAB
LYNNDYL
DELTA
HINCKLEY
GUNNISON
FILLMORE
SALINA
BAKER
MILLARD
KANOSH
RICHFIELD
BEAVER
MILFORD
PIUTE
BEAVER
KINGSTON
MINERSVILLE
IRON
PAROWAN
GARFIELD
PIOCHE
PANACA
ENOCH
MODENA
CEDAR CITY
NEWCASTLE
CALIENTE
WASHINGTON
KANARRAVILLE
LONG VALLEY JCT
NEVADA
UTAH
ARIZONA
MESQUITE
CLARK
LAS VEGAS
LEGEND
DDA SUITABILITY ZONES
HYDROLOGIC SUBUNITS
OB SUITABILITY ZONES
CONCEPTUAL LAYOUTS
CONCEPTUAL ASC LOCATION

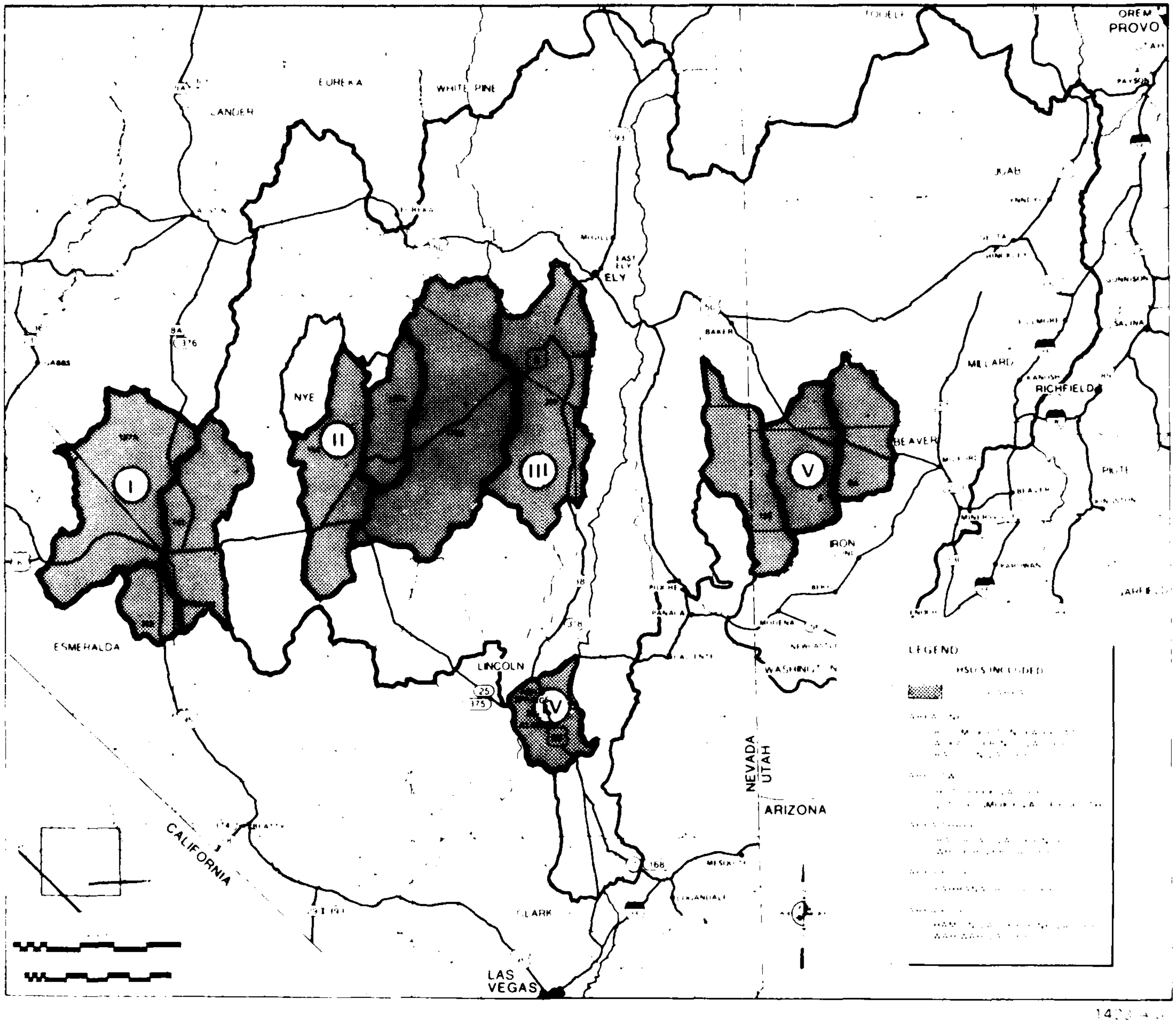


Figure 3.2.2.8-2. Hydrologic subunits chosen for detailed rare plant field studies in the Nevada/Utah study area.

(3) to assemble data regarding the distribution and condition of rare species which occur in the study areas.

Photographs of some of the plant species encountered are presented in Figures 3.2.2.8-3 through 3.2.2.8-7.

Areas selected for study include 11 valleys in 5 general areas of southern Nevada and southwestern Utah. A region surrounding Tonopah, and including Big Smoky Valley-Tonopah Flat, Alkali Springs Valley, and Ralston Valley was designated Area One; Hot Creek Valley and Little Smoky Valley-South were designated Area Two; Railroad Valley-North and White River Valley Area Three; Pahranagat Valley Area Four; and Hamlin, Pine, and Wah Wah valleys, in the easternmost part of the study area, Area Five. The areas sampled comprise approximately 8,640,000 acres and represent a geographic cross-section of the project area.

The field techniques used in the sampling are described in ETR-17, Protected Species. A summary of study results is presented in Table 3.2.2.8-3. Individual rare plants are discussed in greater detail in Chapter 4, FEIS, and ETR-17, Protected Species. Rare and sensitive plant species are listed in Table 3.2.2.8-4.

Wildlife Species (3.2.2.8.2)

Several terrestrial species protected by the Endangered Species Act occur in the study area. The bald eagle winters throughout many of the valleys in the study area. The peregrine falcon migrates through the study area and a few isolated pairs nest to the east of the study area. The Utah prairie dog is a resident species occurring only in southwestern Utah. State protected vertebrates found in or near the area include the desert tortoise (the population on the Beaver Dam Slope in southwestern Utah is federally listed as threatened, with designated critical habitat), gila monster, and spotted bat (Figure 3.2.2.8-8). Wild horses, protected by the Wild Free-Roaming Horse and Burro Act of 1971, occur in many valleys and compete fror forage with domestic livestock and native species (Figure 3.2.2.8-9). A more complete discussion of the distribution of these animals and of impacts to them can be found in ETR-17, Environmental Technical Report on Protected Species.

Aquatic Species (3.2.2.8.3)

Many protected (8 federal and 19 state) and recommended protected (34) aquatic species, both fish and invertebrates, occur in the study area (Figure 3.2.2.7-1, Table 3.2.2.8-5, and 3.2.2.8-6). Most of these species and subspecies resulted from isolation caused by the drying of Pleistocene lakes (10,000-20,000 years ago), forming widely spaced small springs and streams (Smith, 1978).

The habitat requirements of these species are as variable and unique as the habitats themselves. These consist primarily of small areas of low flow occurring in lowlands and mountainous terrain. Springs may be characterized as hot, cold, or variable in temperature, with other similarly variable water quality conditions. Fish

spawn at different times of the year depending largely upon water quality and food availability. Fish in hot springs spawn early in the year or continuously, whereas those in cold water habitats spawn later in the spring. Lowest population levels occur either at midsummer, when water level is lowest, or in winter, when water temperature is lowest. Exotic species, such as mosquitofish, have been introduced both accidentally and intentionally throughout the Great Basin and severely compete with many protected species.

Wilderness/Natural Areas (3.2.2.9)

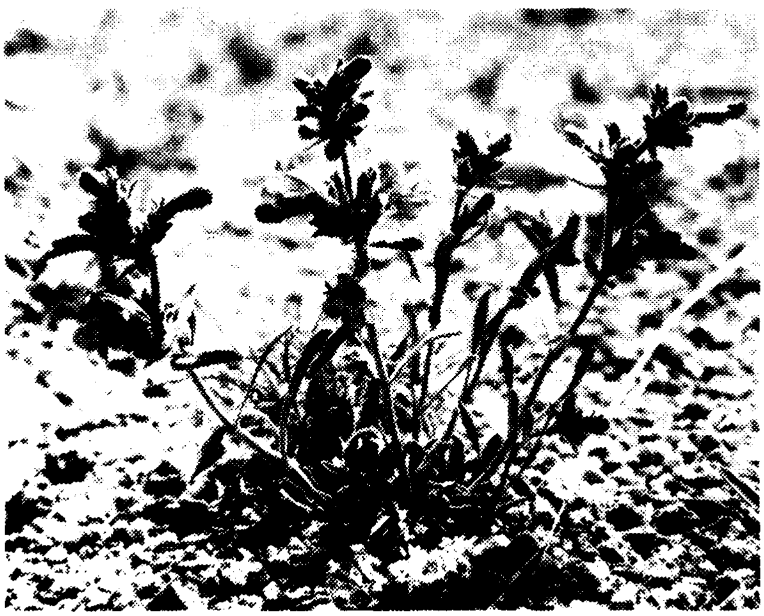
Wilderness/Natural Areas (3.2.2.9.1)

There is no Congressionally Designated Wilderness in the proposed M-X deployment area. Jarbidge, in the Humboldt National Forest in northeastern Nevada, and Lone Peak, in the Uinta and Wasatch National Forest in central Utah, are the nearest designated wilderness areas and are located approximately 125 and 65 air miles, respectively, from the nearest full-basing project feature. Approximately 2.5 million acres of BLM wilderness study area and units under appeal to the Interior Board of Land Appeals (IBLA), as well as approximately 212,000 acres of U.S. Forest Service RARE II Wilderness Recommendations (including Further Planning Units), and, approximately 220,000 acres of Administratively Endorsed Wilderness Proposals (U.S. Fish and Wildlife Service and National Park Service) occur in the vicinity of the proposed M-X deployment area (Figure 3.2.2.9-1). All are in various stages of review for possible inclusion in the National Wilderness Preservation System.

Significant Natural Areas (3.2.2.9.2)

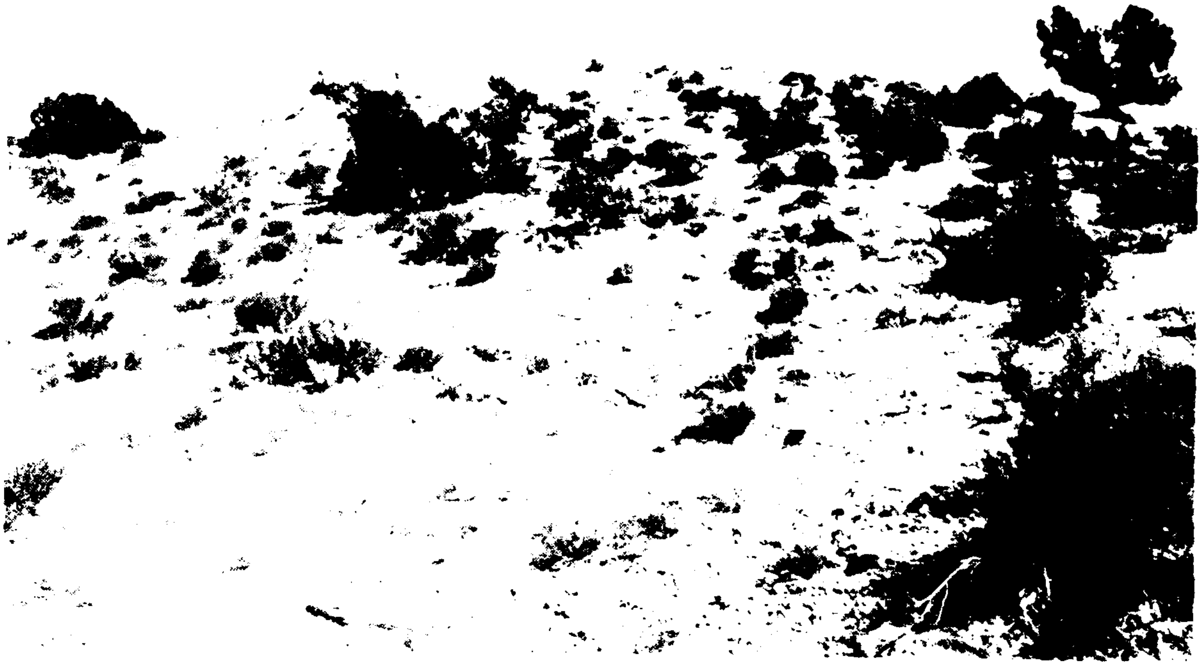
Significant natural areas in the proposed Nevada/Utah siting region include more than 50 proposed/designated National Natural Landmarks, 13 wildlife refuges, 25 Research Natural Areas, and more than 30 other natural areas of ecological significance (Figure 3.2.2.9-2). Most of these areas are protected by one or more federal agencies (Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, U.S. Forest Service). Others are state-protected or privately owned.

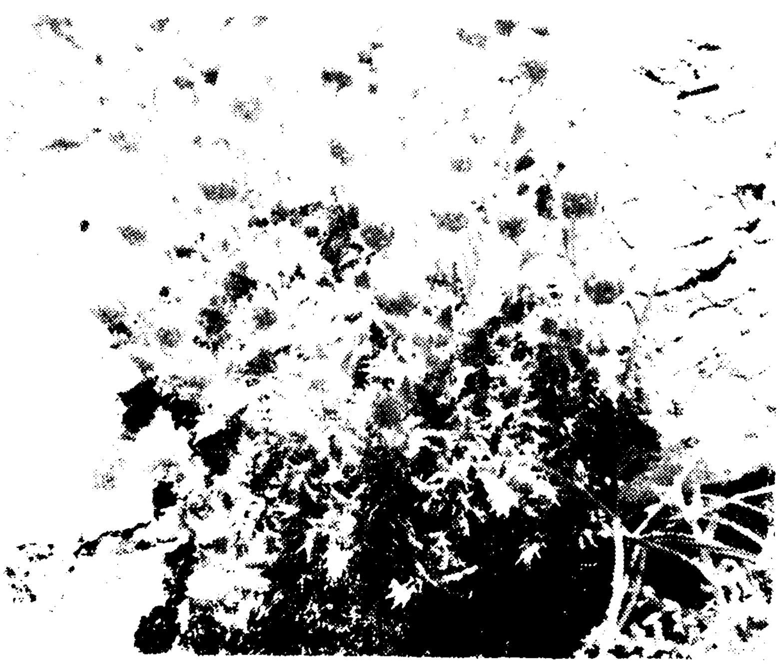
THE DWARF BEARD-TONGUE (*Penstemon nanus*) OCCURS ON GRAVELLY SOIL WITH BLACK SAGEBRUSH, JUNIPER, AND RABBITBRUSH.



2036 A

Figure 3.2.2.8-3. Close-up, aspect, and habitat photographs of the dwarf beard-tongue.





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THE WHITE-LEAF MACHAERANTHERA (*M. leucanthemifolia*) BELOW, OCCURS IN NUMEROUS HABITAT TYPES, INCLUDING SHADSCALE, SAGEBRUSH, AND PINYON-JUNIPER WOODLAND.

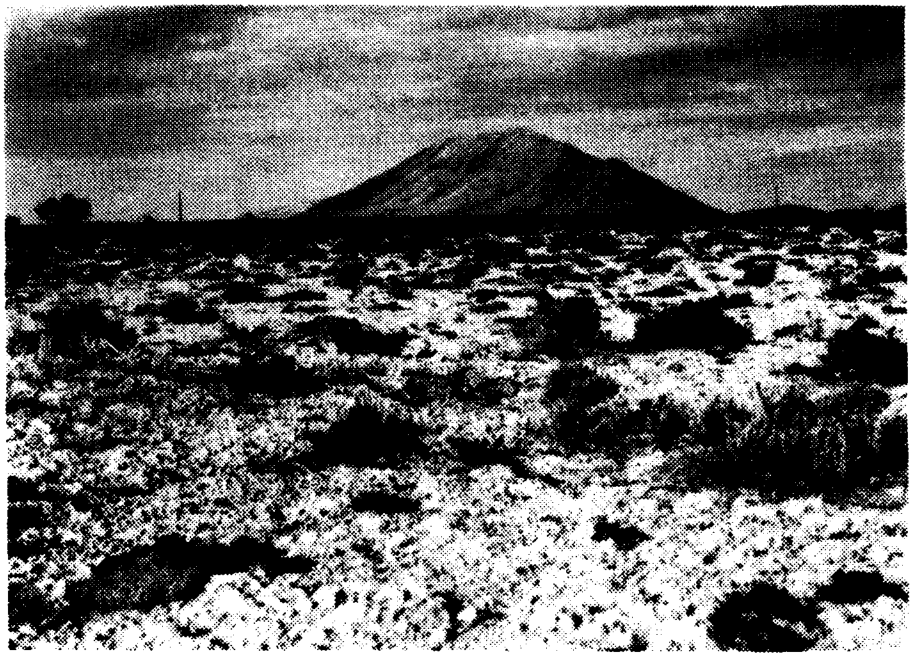
2038-A

Figure 3.2.2.8-5. Close-up and habitat photographs of the white-leaf Machaeranthera.

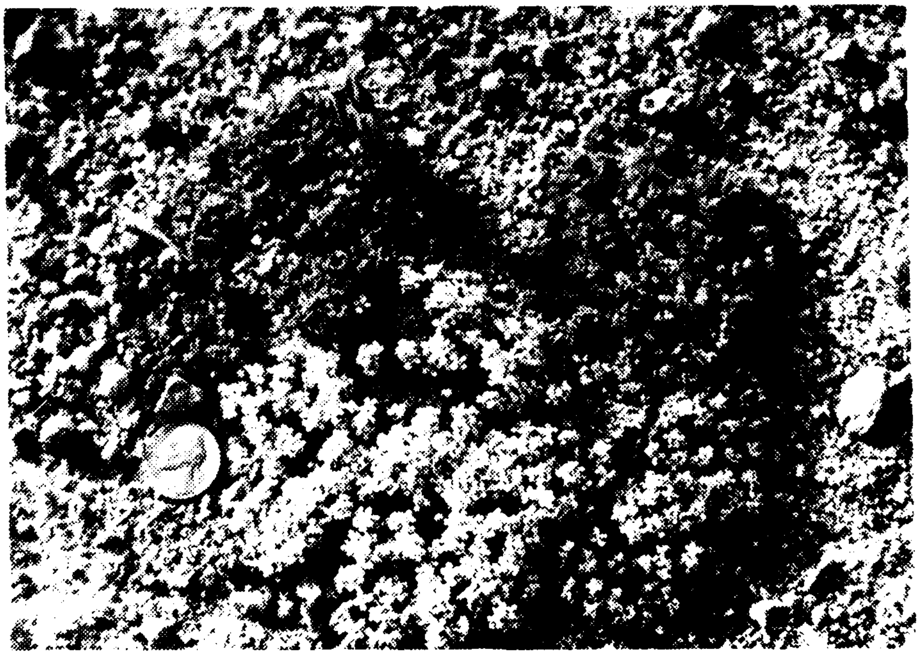
PARTIALLY STABILIZED SAND DUNES PROVIDE SUITABLE HABITAT FOR THE CALLAWAY MILKVETCH (*Astragalus callithrix*), A RARE PLANT WHICH HAS HIGH PRIORITY FOR FEDERAL LISTING.

2039-A

Figure 3.2.2.8-6. Aspect and habitat photographs of the Callaway milkvetch.



DWARF PEPPERGRASS (*Lepidium nanum*) APPEARS TO BE HABITAT SPECIFIC ON WHITE OUTCROPS OF CALCAREOUS PLAYA REMNANT ("GYPSUM MOUNDS") IN WHITE RIVER VALLEY.



2032-A

Figure 3.2.2.8-7. Close-up and habitat photographs of dwarf peppergrass.

Table 3.2.2.8-3. Summary of rare plant field study results.

Locations Searched	Area 1			Area 2		Area 3		Area 4	Area 5			Total
	Big Smoky-Tonopah Flat	Ralston	Alkali Springs	Hot Creek	Little Smoky-Southern	Railroad-Northern	White River	Pahranagat	Hamlin	Pine	Wah Wah	
Sites where no rare species were found	11	6	2	4	3	12	6	10	1	2	7	64
Sites where rare species were found	17	19	2	19	5	42	23	19	18	42	19	225
Locations with new records	10	10	2	11	5	32	18	14	14	30	15	161
Total locations searched	28	25	4	23	8	54	29	29	19	44	26	289

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Table 3.2.2.8-4. Initial list of rare or sensitive plant species considered in the Nevada/Utah study region. (Page 1 of 6).

Species, Author	Letter Code	Federal Status[2]
Agave utahensis Engelm. var. eborispina (Hester) Brietung	AGUTE	2
Agave utahensis Engelm. var. nevadensis Engelm. ex. Greenm. & Roush	AGUTN	2
Angelica scabrida Clokey & Mathias eax. Clokey	ANSC	1
Antennatia arcuata	ANAR	2
Antennaria soliceps Blake	ANSO	1
Arabis dispar M.E.Jones	AROI	3c
Arabis shockleyi Munz	ARSH	3c
Arctomecon Californica Torr. and Frem.	ARCA	1
Arctomecon humilis Coville	ARHU	FE
Arctomecon merriamii Coville[1]	ARME	2
Arenaria kingii (Wats.) Jones var. rosea Mag.[1]	ARKIR	1
Arenaria stenomeres Eastw.[1]	ARST	1
Artemisia papposa Blake & Cronq[1]	ARPA	1
Asclepias eastwoodiana Barneby[1]	ASEA	2
Astragalus ackermanii Barneby[1]	ASAC	2
Astragalus aequalis Clokey	ASEAQ	1
Astragalus alvordensis M.E. Jones	ASAL	3c
Astragalus ampullarius Wats.	ASAM	2
Astragalus beatleyae Barneby[1]	ASBE	1
Astragalus callithrix Barneby[1]	ASCA	2
Astragalus calycosus Torr. var. monophyllidius (Rydb.) Barneby[1]	ASCAM	1
Astragalus cimae Jones var. cimae[1]	ASCIC	2
Astragalus convallarius Greene, var. finitimus Barneby[1]	ASCOF	2
Astragalus deseriticus Barneby[1]	ASDE	1*
Astragalus funereus Jones[1]	ASFU	1
Astragalus geyeri Gray var. triquetrus (Gray) Jones[1]	ASGET	1
Astragalus lancearius A. Gray	ASLA	3c
Astragalus lentiginosus Doug. var. latus (Jones) Jones[1]	ASLEL	2
Astragalus lentiginosus Doug. var. micans Barneby	ASLEM	1
Astragalus lentiginosus Doug. var. sesquimetralis (Rydb.) Barneby	ASLES	1
Astragalus lentiginosus Doug. var. ursinus (A. Gray) Barneby	ASLEU	1
Astragalus limnocharis Barneby	ASLI	1
Astragalus mohavensis Wats. var. hemigyrus (Clokey) Barneby	ASMOH	1
Astragalus musimonum[1]	ASMU	2
Astragalus nyensis Barneby	ASNY	3c
Astragalus perianus Barneby	ASPE	FE
Astragalus oophorus Wats. var. clokeyanus Barneby	ASOOC	1
Astragalus oophorus Wats. var. lonchocalyx Barneby[1]	ASOOL	2
Astragalus phoenix Barneby	ASPH	1
Astragalus porrectus S. Wats.	ASPO	1
Astragalus pseudiodanthus Barneby[1]	ASPS	2
Astragalus pterocarpus M. E. Jones	ASPT	2
Astragalus robbinsii var. occidentalis Wats.[1]	ASROO	1
Astragalus serenoi (Kuntze) Sheld. var. sordescens Barneby[1]	ASSES	1
Astragalus solitarius	ASSO	2

Table 3.2.2.8-4. Initial list of rare or sensitive plant species considered in the Nevada/Utah study region. (Page 2 of 6).

Species, Author	Letter Code	Federal Status[2]
Astragalus striatiflorus M. E. Jones	ASST	1
Astragalus tephrodes var. eurylobus[1]	ASTEE	2
Astragalus toquimanus Barneby[1]	ASTO	1
Astragalus uncialis Barneby[1]	ASUN	1
Astragalus yoder-williamsii[1]	ASYO	FE(E)
Brickellia knappiana E. Drew[1]	BRKN	2
Calochortus striatus Parish. Deleted	CAST	2
Camissonia megalantha (Munz) Raven = C. heterochroma	CAME	2
Camissonia nevadensis Kell.	CANE	2
Castilleja parvula Rydb.	CAPA	1
Castilleja salsuginosa N. Holmgren[1]	CASA	1
Centaurium namophilum Reveal, Broome & Beatley var. namophilum	CENANA	1
Cirsium clokeyi Blake	CICL	3c
Cordylanthus tecopensis Munz & Roos.	COTE	2
Coryphantha vivipara (Nutt.) Britt. & Rose var. rosea (Clokey) L. Benson[1]	COVIR	2
Cryptantha compacta Higgins[1]	CRCO	1
Cryptantha hoffmanii Johnst.	CRHO	1
Cryptantha insolita (MacBr.) Payson	CRINS	1*
Cryptantha interrupta (Greene) Payson	CRINT	3c
Cryptantha tumulosa (Payson)[1]	CRTU	1
Cuscuta warneri Yuncker[1]	CUWA	1*
Cymopterus basalticus M. E. Jones[1]	CYBA	2
Cymopterus corrugatus (M. E. Jones) Wats.	CYCOR	3c
Cymopterus coulteri (M. E. Jones) Mathias	CYCOU	1
Cymopterus minimus (Mathias) Mathias	CYMI	1
Cymopterus nivalis Wats.	CYNI	2
Cymopterus ripleyi Barneby var. saniculoides[1]	CYRIS	2
Cymopterus goodrichii Welsh[1]	CYGO	1
Dalea kingii (S. Wats.) Barneby	DAKI	3c
Draba arida C. L. Hitchc.[1]	DRAR	2
Draba asperella Greene var. zionensis (C. L. Hitchc.) Welsh & Reveal	DRASZ	2
Draba asterophora Pays var. asterophora	DRASA	2
Draba crassifolia (Graham) var. nevadensis C. L. Hitchc.[1]	DRCRN	1
Draba douglassii A. Gray var. crockeri	DRDOC	2
Draba jaegeri Munz. & Johnst.	DRJA	1
Draba paucifructa Clokey & C. L. Hitchc.	DRPA	1
Draba sobolifera Rydb.	DRSO	1
Draba sphaeroides Pays. var. cusickii (Robbins.) Hitchc.	DRSPC	3c
Draba stenoloba Ledeb. var. ramosa C. L. Hitchc.	DRSTR	2
Draba subalpina Goodman & Hitchc.	DRSU	3c
Echinocereus engelmannii (Parry) Lemaire var. purpureus L. Benson	ECENP	FE
Elodea nevadensis	ELNE	1
Enceliopsis nudicaulis (A. Gray) A. Nels. var. corrugata Cronq.	ENNU	1

Table 3.2.2.8-4. Initial list of rare or sensitive plant species considered in the Nevada/Utah study region. (Page 3 of 6).

Species, Author	Letter Code	Federal Status[2]
Ephedra funerea Cov. and Morton	EPFU	3c
Epilobium nevadense Munz.	EPNE	1
Erigeron latus (Nels. & Macbr.) Cronquist[1]	ERLA	1
Erigeron ovinus Cronq.[1]	EROV	2
Erigeron proselyticus Neson	ERPR	1
Erigeron religiosus Cronq.	ERRE	3c
Erigeron uncialis Blake var. conjugans (Blake) Cronq.[1]	ERUNC	2
Eriogonum ammophilum Reveal[1]	ERAM	1
Eriogonum anemophilum Greene[1]	ERAN	3c
Eriogonum argophyllum Reveal[1]	ERAR	1
Eriogonum beatleyae Reveal	ERBE	3c
Eriogonum bifurcatum Reveal	ERBI	2
Eriogonum concinnum Reveal	ERCO	3c
Eriogonum corymbosum Benth. var. matthewsiae Reveal	ERCOm	1
Eriogonum darrovii Kearney	ERDA	3c
Eriogonum eremicum Reveal[1]	ERER	2
Eriogonum holmgrenii Reveal[1]	ERHO	1
Eriogonum jamesii Benth. var. rupicola Reveal	ERJAR	1
Eriogonum lemmonii S. Wats.	ERLE	1
Eriogonum lobbii T&G var. robustius (Greene) Jones	ERLOR	1
Eriogonum natum Reveal[1]	ERNA	1
Eriogonum nummulare[1]	ERNU	2
Eriogonum ostlundii M.E. Jones	EROS	2
Eriogonum ovalifolium Nutt. var. caelestinum Reveal	EROVC	3c
Eriogonum ovalifolium var. nov.	EROVN	1
Eriogonum panguicense (M. E. Jones) Reveal var. alpestre (S. Stokes) Reveal	ERPAA	1
Eriogonum rubricaule Tidestrom	ERRU	3c
Eriogonum thompsonae S. Wats. var. albiflorum Reveal	ERTHA	3c
Eriogonum viscidulum J. T. Howell[1]	ERVI	1
Eriogonum zionis J. T. Howell var. zionis	ERZIZ	3c
Ferocactus acanthodes (Lemaire) Britt & Rose var. acanthodes	FEACA	2
Forsellesia pungens (Bdg.) Heller var. glabra[1] (?)	FOPU	2
Frasera gypsicola (Barneby) D. M. Post[1]	FRGY	1
Frasera pahutensis Reveal[1]	FRPA	1
Fraxinus cuspidata var. macropetala[1]	FRCUM	2
Galium hilendiae (Dempster & Ehrendorfer) var. kingstonense (Dempster) Dempster & Ehrendorfer	GAHIK	1
Geranium toquimense Holmgren & Holmgren	GETO	3c
Gilia nyensis Reveal[1]	GINY	2
Gilia ripleyi Barneby	GIRI	3c
Grindelia fraxino-pratensis Reveal & Beatley	GRFR	1
Hackelia ophiobia	HAOP	1
Haplopappus alpinus Anderson[1]	HAAL	2
Hazardia brickellioides Blake	HABR	3c
Haplopappus eximius Hall	HAEX	3c
Haplopappus watsonii A. Gray	HAWA	3c

T5041/9-8-81/F

Table 3.2.2.8-4. Initial list of rare or sensitive plant species considered in the Nevada/Utah study region. (Page 4 of 6).

Species, Author	Letter Code	Federal Status[2]
Helianthus deserticolus Heiser	HEOE	3c
Heuchera duranii	HEOU	3c
Hulsea vestita A. Gray var. inyoensis (Keck) Wilken	HUVEI	3c
Hymenopappus filifolius Hook var. tomentosus (Rydb.)	HYFIT	3c
Ivesia cryptocaulis (Clokey) Keck	IVCR	1
Ivesia eremica (Cov.) Rydb.	IVER	1
Lathyrus hitchcockianus Barneby & Reveal[1]	LAHI	1
Lepidium nanum S. Wats.[1]	LENA	2
Lepidium ostleri Welsh[1]	LEOS	1
Lesquerella hitchcockii Munz[1]	LEHI	2
Lewisia maguirei Holmgren[1]	LEMA	1
Linanthus arenicola (Jones) Jeps. & Bail.	LIAR	3c
Lomatium ravenii Math. & Const.	LORA	3c
Lupinus holmgrenanus C. P. Smith	LUHO	3c
Lupinus jonesii Rydb.	LUJO	2
Lupinus malacophyllus Greene	LUMA	2
Lupinus montigenus Heller. var. mortigenus	LUMON	3c
Machaeranthera grindelioides var. depressa	MAGRD	3c
Machaeranthera leucanthemifolia (Greene) Greene	MALE	3c
Mentzelia leucophylla Bdg.	MELE	1
Mertensia toiyabensis MacBride[1]	METO	2
Mimulus washoensis Edwin	MIWA	3b
Mirabilis pudica Barneby	MIPU	3c
Opuntia pulchella Engelm.	OPPU	3c
Opuntia whipplei Engelm. & Bigel. var. multigeniculata (Clokey) L. Benson	OPWHM	2
Oryctes nevadensis Wats.[1]	ORNE	2
Oxytheca watsonni T&G[1]	OXWA	1
Pediocactus sileri (Engelm.) L. Benson[1]	PESI	FE
Penstemon arenarius Greene	PEAR	1
Penstemon bicolor (Brandegee) Clokey & Keck var. bicolor[1]	PEBIB	1
Penstemon bicolor (Brandegee) Clokey & Keck var. roseus Clokey & Keck	PEBIR	1
Penstemon concinnus Keck[1]	PECO	1
Penstemon franciscipennellii Crosswhite[1]	PEFR	1
Penstemon fruticiformis Cov. var. amargosae Keck	PEFRA	1
Penstemon humilis Nutt. var. obtusifolius (Pennell)	PEHUO	2
Penstemon keckii Clokey	PEKE	2
Penstemon moriahensis Holmgren.[1]	PEMO	2
Penstemon nanus Keck[1]	PENA	2
Penstemon pahutensis N. Holmgren	PEPA	1
Penstemon procerus Dougl. ex Graham var. modestus (Greene) N. Holmgren[1]	PEPRM	1
Penstemon pudicus Reveal & Beatley[1]	PEPU	1
Penstemon rubicundus Keck	PERU	2
Penstemon thompsoniae (Gray) Rydb. var. jaegeri Keck[1]	PETHJ	2
Penstemon thurberi Torr. var. anestius Reveal & Beatley	PETHA	3b
Penstemon tidestromii Pennell	PETI	1

Table 3.2.2.8-4. Initial list of rare or sensitive plant species considered in the Nevada/Utah study region. (Page 5 of 6).

Species, Author	Letter Code	Federal Status[2]
Penstemon wardii A. Gray	PEWA	1
Penstemon sp. Holmgren		
Perityle megalocephala (Wats.) Macbr. var. intricata (Brandeg.) Powell[1]	PEMEI	2
Peteria thompsonae S. Wats.	PETH	3c
Phacelia anelsonii (J. F. MacBride)[1]	PHAN	2
Phacelia argillaceae Atwood	PHAR	FE
Phacelia beatleyae Reveal & Constance	PHBE	1
Phacelia cephalotes Gray	PHCE	2
Phacelia glaberrima (Torr.) J. T. Howell[1]	PHGLA	1
Phacelia inconspicua Greene	PHIN	1
Phacelia mustelina Coville	PHMU	3c
Phacelia nevadensis J. T. Howell	PHNE	2*
Phacelia parishii Gray[1]	PHPA	2
Phlox gladiformis (M. E. Jones) E. Nels.	PHGLD	2
Pilostyles thurberi Gray.	PITH	3c
Polygala subspinosa Wats. var. heterorhynca Barneby	POSUH	2
Primula capillaris N. Holmgren & A. Holmgren[1]	PRCA	1
Primula nevadensis N. Holmgr.[1]	PRNE	1
Rorippa subumbellata Roll.	ROSU	1
Salvia funerea M. E. Jones	SAFU	3c
Sclerocactus polyancistrus (Engel. & Bigel.) Britt. & Rose[1]	SCPO	1
Sclerocactus pubispinus (Engelm) L. Benson[1]	SCPU	1
Selaginella utahensis Flowers	SEUT	2
Silene clokeyi Hitchc. & Mag.	SICL	1
Silene petersonii Maguire var. minor Hitchc. & Mag.	SIPEM	1
Silene scaposa Robinson var. lobata Hitchc. & Mag.	SISCL	3c
Smelowskia holmgrenii Rollins	SMHO	3c
Sphaeralcea caespitosa M. E. Jones[1]	SPCA	2
Sphaeromeria compacta (Hall) Holmgren	SPCO	1
Sphaeromeria ruthiae Holm., Schultze and Lowrey	SPRU	1
Streptanthus oliganthus Roll.	STOL	1
Synthyris ranunculina Pennell	SYRA	1
Thelypodium laxiflorum (Al-Shebaz)	THLA	3c
Thelypodium sagittatum (Nutt.) Endl. var. ovalifolium (Rydb.) Welsh & Reveal[1]	THSAO	2
Townsendia jonesii (Beaman) Reveal var. tumulosa Reveal[1]	TOJOT	1
Trifolium andersonii Gray var. beatleyae Gillett[1]	TRANB	2
Trifolium andersonii var. friscanum[1]	TRANF	1
Trifolium lemmonii Gray	TRLE	1
Viola purpurea Kellogg var. charlestonensis (Baker & Clausen) Welsh & Reveal	VIPUC	2
Zigadenus vaginatus (Rydb.) Baker & Clausen ex. Clokey Macbr.[1]	ZIVA	2

T5041/9-8-81/F

Table 3.2.2.8-4. Initial list of rare or sensitive plant species considered in the Nevada/Utah study region. (Page 6 of 6).

T5341/9-8-81/F

[1]These species are mapped on USGS topographic sections. See Appendix A-3 of ETR-17.

[2]FE = Federally listed as threatened or endangered; 1 = Taxa for which the U.S.F.W.S. presently has some information on hand to support their being listed as endangered or threatened species; 2 = Taxa for which the U.S.F.W.S. presently has some information on hand to support their being listed as endangered or threatened species, but for which more information is needed. An asterisk (*) indicates that taxon is possibly extinct. 3b, c = Taxa no longer under review.

Source: This list was compiled primarily on the basis of recommendations received from the Northern Nevada Native Plant Society and the Utah Native Plant Society. Federal status is from FR, Dec. 15, 1980. See text for detail.

LEGEND

THREATENED AND ENDANGERED WILDLIFE SPECIES

BALD EAGLE WINTERING AREA (ESTIMATED)

BALD EAGLE KNOWN ROOST SITE

DESERT TORTOISE RANGE (APPROXIMATE)

DESERT TORTOISE CRITICAL HABITAT

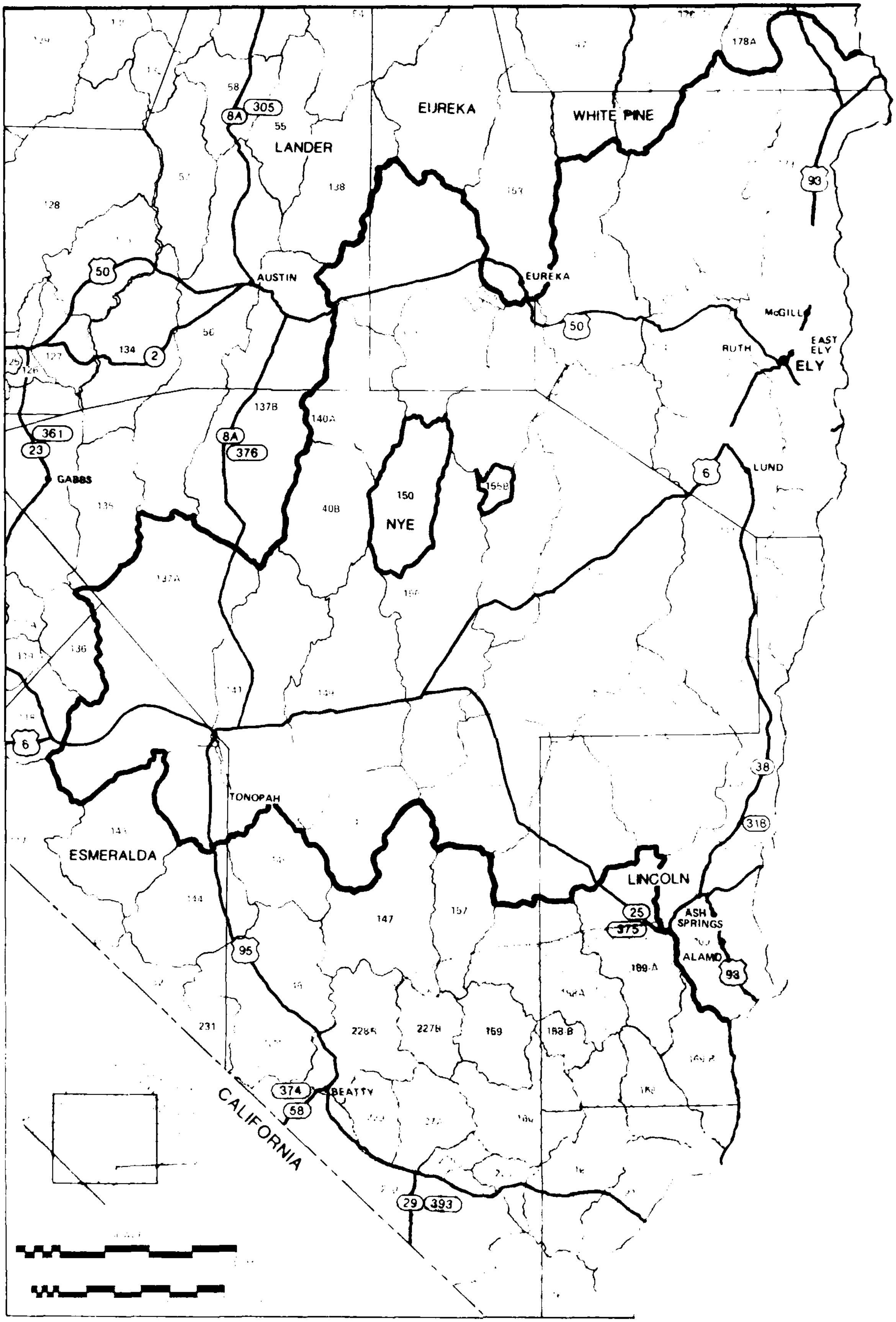
GILA MONSTER RANGE (APPROXIMATE)

PEREGRINE FALCON: REGION CONTAINING ACTIVE NESTS SINCE 1960

SPOTTED BAT SIGHTING

UTAH PRAIRIE DOG RANGE (AREA ENCOMPASSES KNOWN PRAIRIE DOG TOWNS)

0654-E/0662-E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8A
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LANDER
EUREKA
WHITE PINE
178A
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128
138
50
AUSTIN
EUREKA
McGILL
50
134
2
RUTH
EAST ELY
ELY
137B
140A
361
23
8A
376
GABBS
6
LUND
150
NYE
40B
156B
137A
136
6
38
TONOPAH
318
ESMERALDA
LINCOLN
147
157
25
375
ASH SPRINGS
ALAMO
95
93
231
228B
227B
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189 A
168 B
374
BEATTY
58
CALIFORNIA
29
393

4459 D

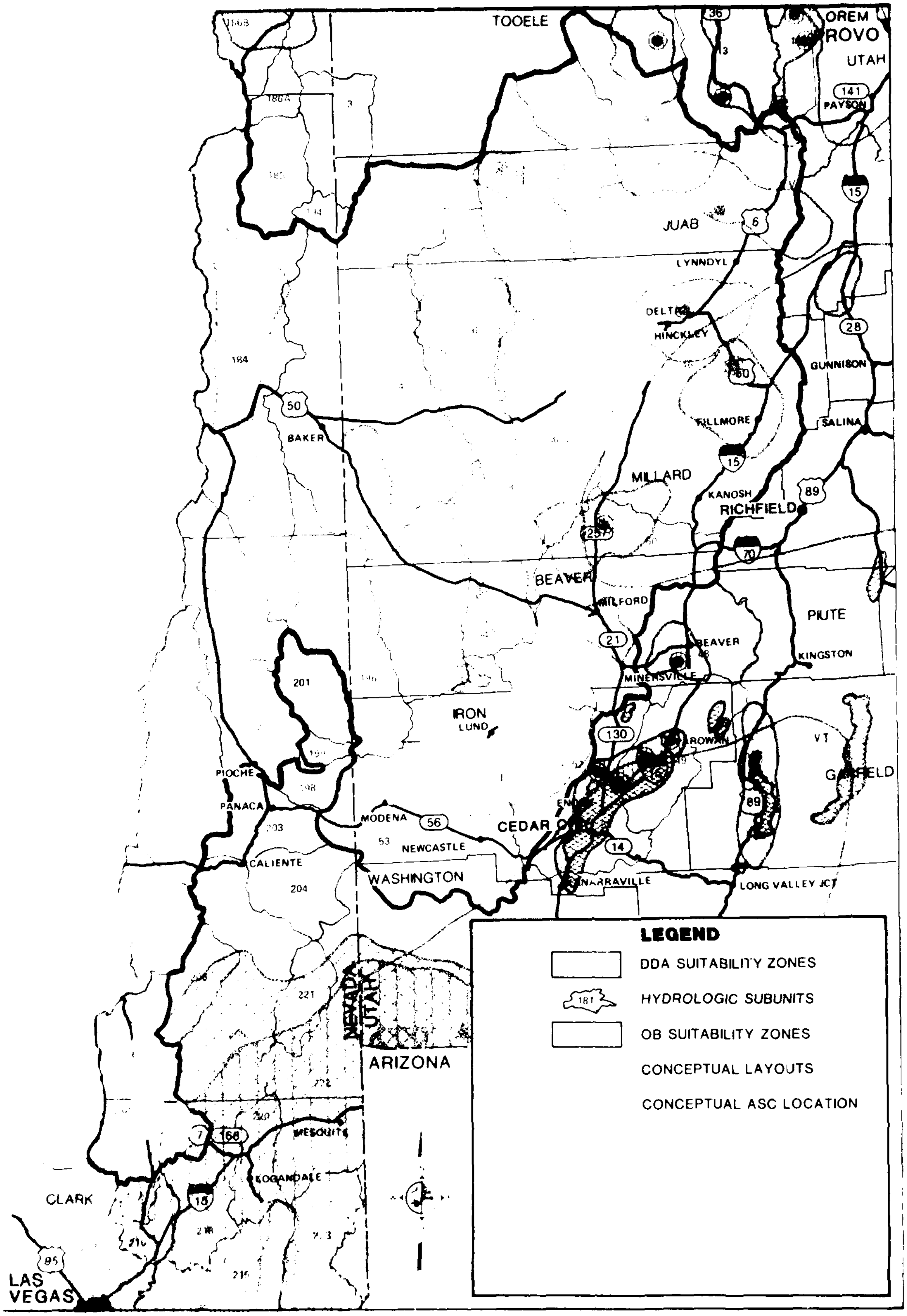

Figure 3.2.2.8-8. Distribution of threatened and endangered wildlife species in the Nevada/Utah study area.

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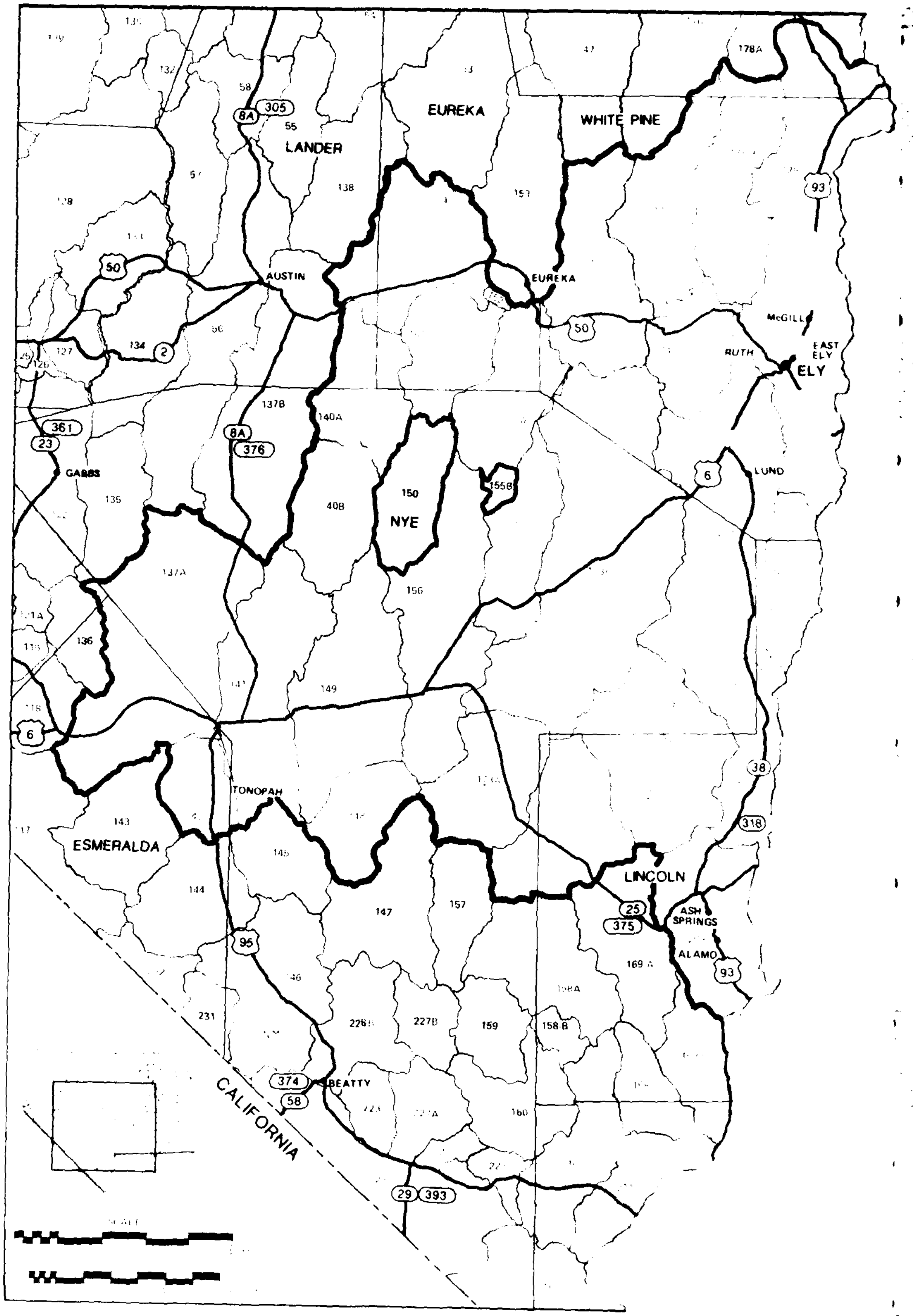
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LINCOLN
ASH SPRINGS
ALAMO
BEATTY
CALIFORNIA
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137B
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155B
40B
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156
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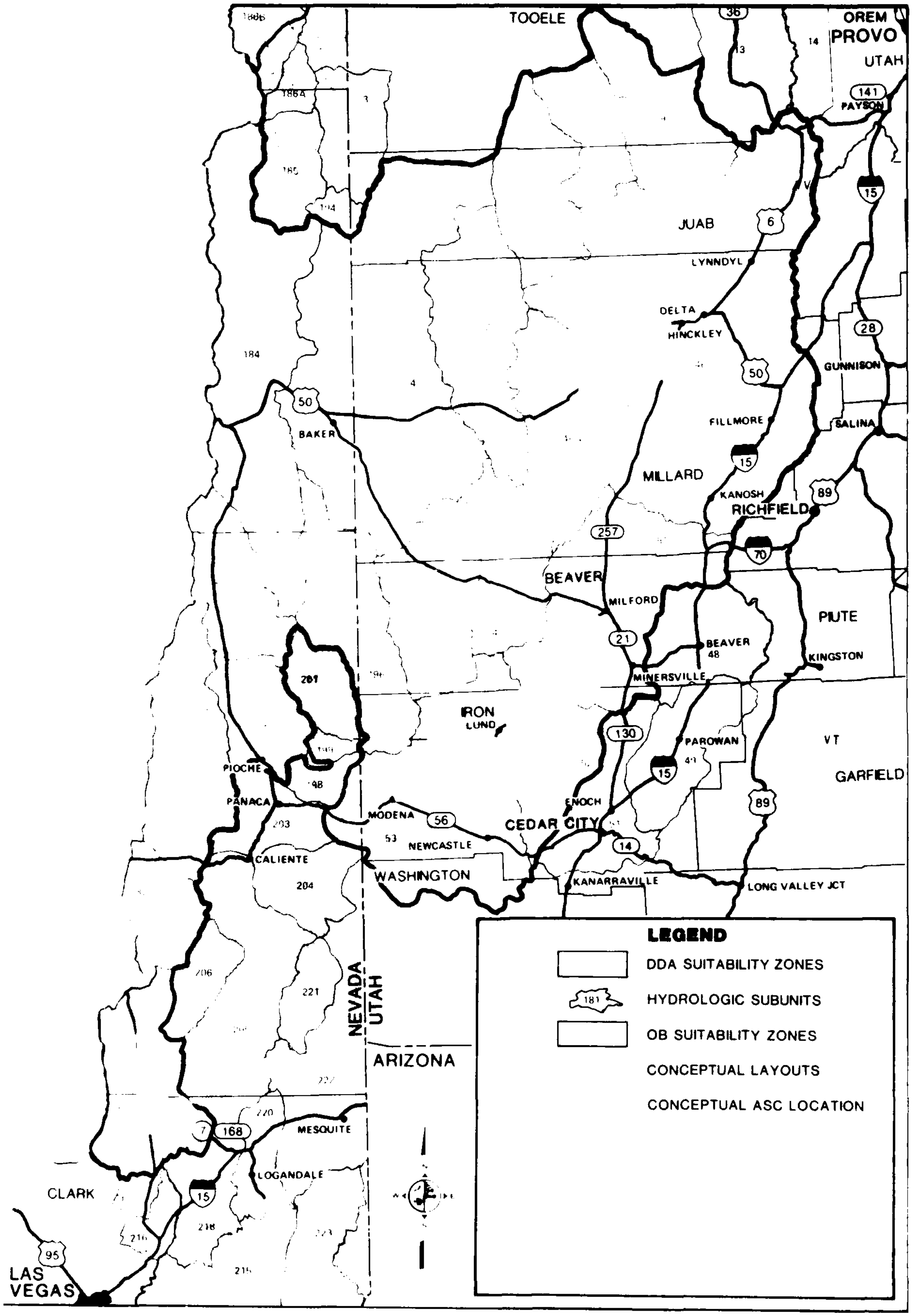

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Figure 3.2.2.8-9. Wild horse and burro herd locations in the Nevada/Utah study area.

Table 3.2.2.8-5 Summary of the recommended protected invertebrates in the Nevada/Utah study area (Page 1 of 2).

Common Name	Scientific Name	Landye (1980)	HDR (1980)	Map Symbol
Mollusca-Gastropods				
Bulimidae				
Moapa Valley turban	"Fluminicola" avernalis	T		20
Ash Meadows turban	"F." erythropoma	E		21
Pahranagat Valley turban	"F." merriami	T		22
Hot Creek turban	"F." n. sp.	E		23
Steptoe turban	"F." nevadensis	T/E		24
Assimeidae				
Overton assiminea	Assiminea n. sp.	E		19
Hydrobiidae				
White River Valley fontelicella	Fontelicella n. sp.	E		25
Ruby Valley fontelicella	F. n. sp.	T/E		26
Currant fontelicella	F. n. sp.	T/E		27
Duckwater fontelicella	F. n. sp.	T/E		28
Red Rock fontelicella	F. n. sp.	T/E		29
White River Valley hydrobiid	N. gen., n. sp.	E		30
Duckwater snail	N. gen., n. sp.	T/E		31
Corn Creek snail	N. gen., n. sp.	T/E		32
Ash Meadows tryonia	Tryonia n. sp.	E		33
Moapa tryonia	T. clathrata	T/E		34
Physidae				
Zion Canyon physa	Physa zioni	E		35

T3518/9-15-81/F

Table 3.2.2.8-5 Summary of the recommended protected invertebrates in the Nevada/Utah study area (Page 2 of 2).

Common Name	Scientific Name	Landye (1980)	HDR (1980)	Map Symbol
Mollusca-Gastropods (cont.)				
Lymnaeidae				
Russell's snail	Lymnaea pilsbryi	T/E		36
Insects				
Dipterans (Blepharoceridae)				
Virgin River net-winged midge	Blepharicera zioni		T/E	37
Hemipterans (Naucoridae)				
Ash Springs creeping water bug	Pelocoris shoshone		T/E	38
Moapa creeping water bug	Usingerina moapensis		T/E	39
Plecopterans (?)				
Giant stonefly nymph	N. gen., n. sp.		T/E	40

T3518/9-15-81/F

n. sp. = unnamed new species
N. gen. = unnamed new genus

Recommended classification:

T = Threatened.
E = Endangered.
T/E = Either threatened or endangered.

Table 3.2.2.8-6. Summary of the legal status of protected and recommended protected fish in the Nevada/Utah study area (Page 1 of 2).

Common Name	Scientific Name	Present Classification		Recommended Classification			Map Symbol Figure 3.2.2.7-1
		Federal	State	Deacon et al. (1979)	Hardy (1980)	Deacon et al. (1980)	
Killifishes (Cyprinodontidae)							
Ash Meadows Amargosa pupfish	Cyprinodon nevadensis mionectes		T	T			A
Devil's Hole pupfish	C. diabolis	E	E	E			H
Warm Springs Amargosa pupfish	C. nevadensis pectoralis	E	T	E			G
Pahrump killifish	Empetrichthys latos latos	E	E	E			N
Railroad Valley springfish	Crenichthys nevadae		T	SC			E
Preston White River springfish	C. baileyi albivallis		T	T	SC/T		L,1
Moorman White River springfish	C. b. thermophilus		T	T	SC/T		L,2
Hiko White River springfish	C. b. grandis		T	T	SC/T		L,3a
White River springfish	C. b. baileyi		T	T	E		L,3
Moapa White River springfish	C. b. moapae		T	T	SC		L,3b
Minnows (Cyprinidae)							
Ash Meadows speckled dace	Rhinichthys osculus nevadensis			E	T/E		4
Independence Valley speckled dace	R. o. lethoporus			E			5
Clover Valley speckled dace	R. o. oligoporus			E			6
Moapa speckled dace	R. o. moapae			T	T/SC		7
White River speckled dace	R. o. velifer				T/E		18
Moapa dace	Moapa coriacea	E	T	E			0
Fish Creek Spring tui chub	Gila bicolor euchila			E	E/T		13
Independence Valley tui chub	G. b. isolata			T	T/E		11
Newark Valley tui chub	G. b. newarkensis			SC	SC/T		8
Lahontan tui chub	G. b. obesa			SC	T/E		9
Pahranagat roundtail chub	G. robusta jordani	E	E	E			L
Virgin River roundtail chub	G. r. seminuda		SC(U)	E	T		S
Least chub	Iotichthys phlegethonis		T(U)	T			Q
White River spinedace	Lepidomeda albivalis		T	T	T/E	E	J
Virgin spinedace	L. mollispinis mollispinis		SC(U)	T			R
Big Spring spinedace	L. m. pratensis		SC	E			I
Woundfin	Plagopterus argentissimus	E	T,E(U)	E	E		T
Relict dace	Relictus solitarius			SC	T/SC		C
Suckers (Catostomidae)							
White River desert sucker	Catostomus clarki intermedius		T	T	SC/T	E	K
June sucker	Chasmistes liorus		E(U)	SC			14
Cui-ui	C. cujus	E	E	E			B

E729/8-18-81

Table 3.2.2.8-6. Summary of the legal status of protected and recommended protected fish in the Nevada/Utah study area (Page 2 of 2).

Common Name	Scientific Name	Present Classification		Recommended Classification			Map Symbol Figure 3.2.2.7-1
		Federal	State	Deacon et al. (1979)	Hardy (1980)	Deacon et al. (1980)	
Trout (Salmonidae)							
Lahontan cutthroat trout	Salmo clarki henshawi	T		T			P
Bonneville cutthroat trout	S. c. utah			T			F
Sculpin (Cottidae)							
Utah Lake sculpin	Cottus echinatus			E			16

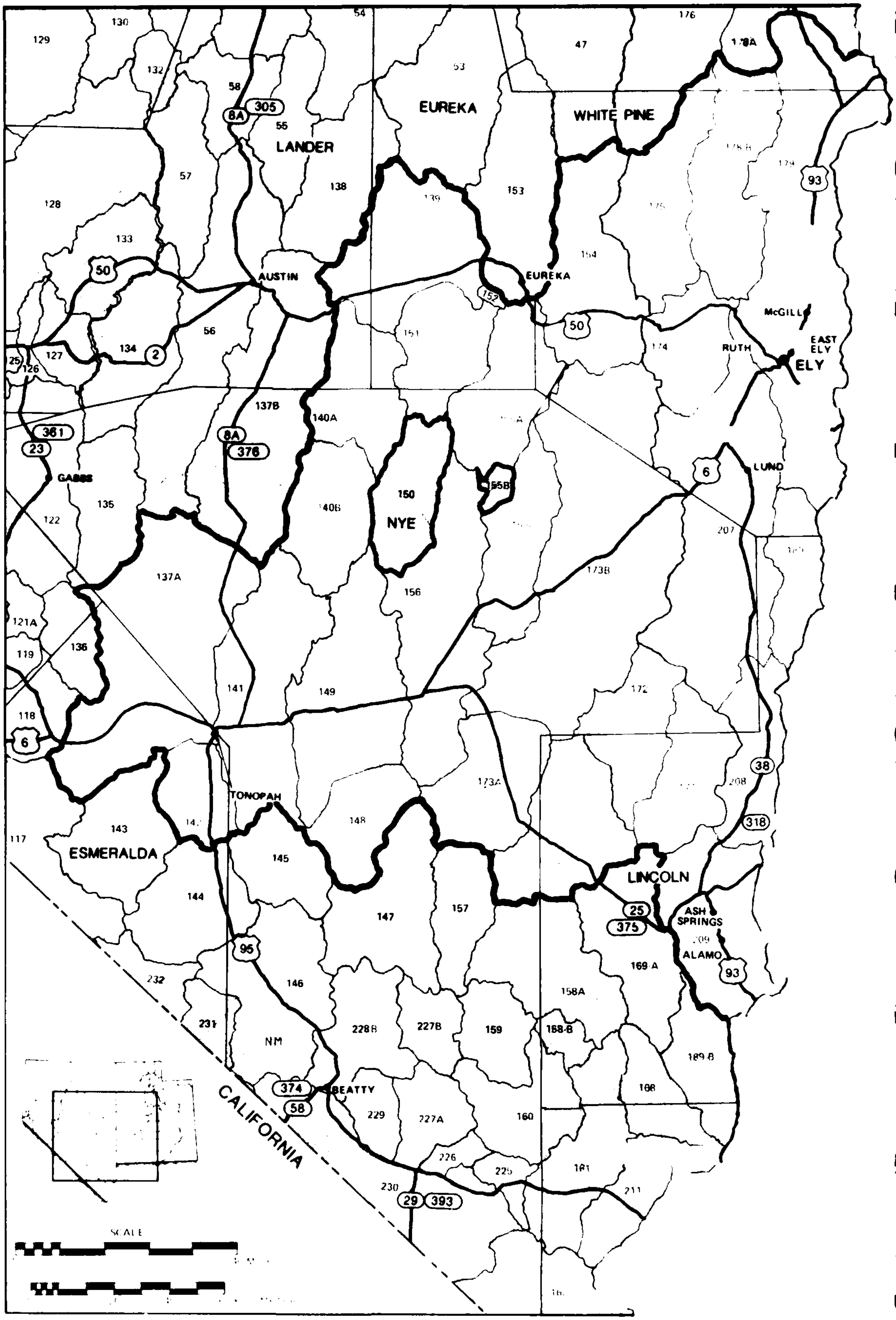
T720/8-18-81

(U) - Utah state protected

SC - Special Concern or protected

T - Threatened, Rare, or Declining

E - Endangered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LUND
GABBS
TONOPAH
BEATTY
ASH SPRINGS
ALAMO
NM
SCALE

4459-D

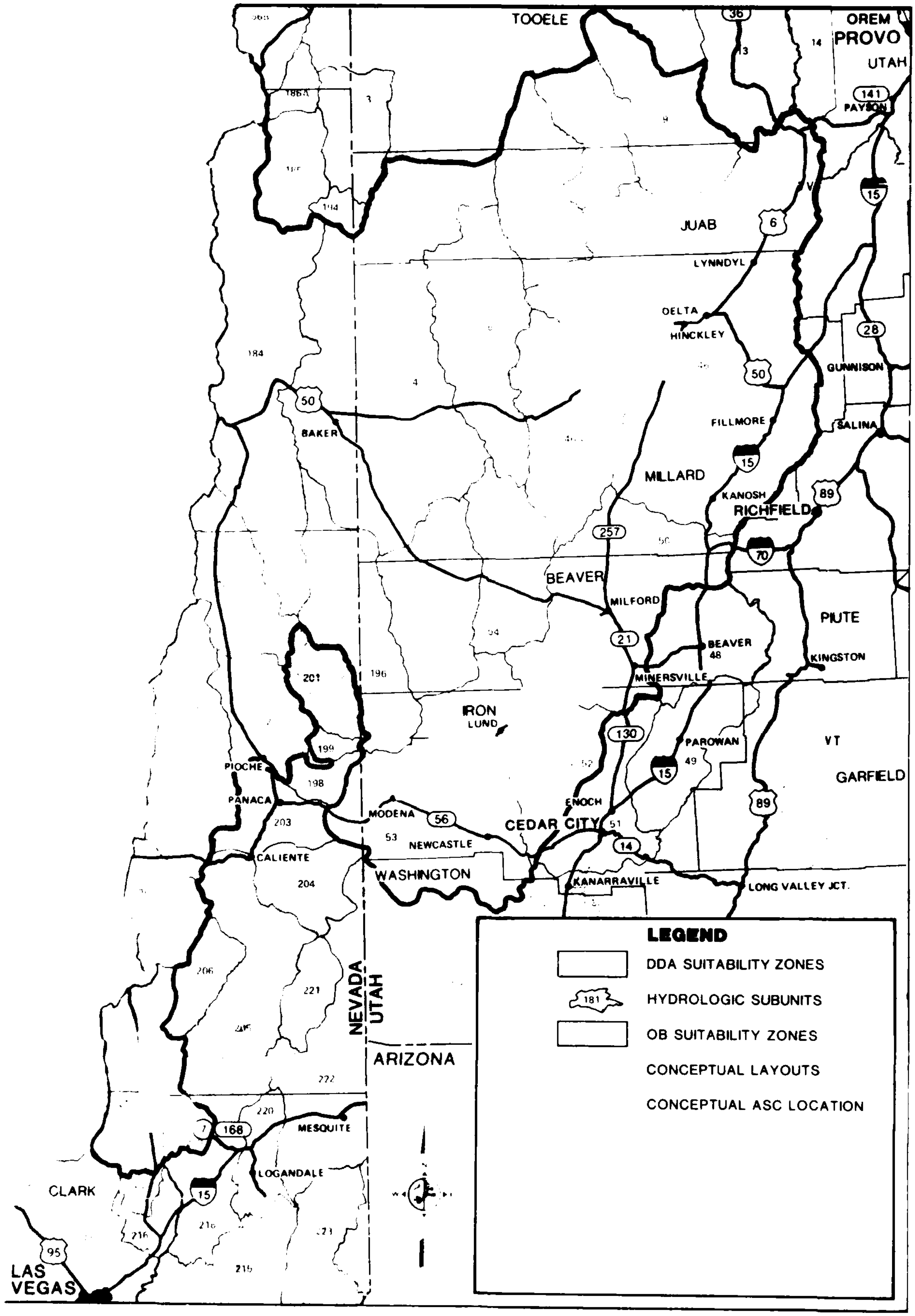
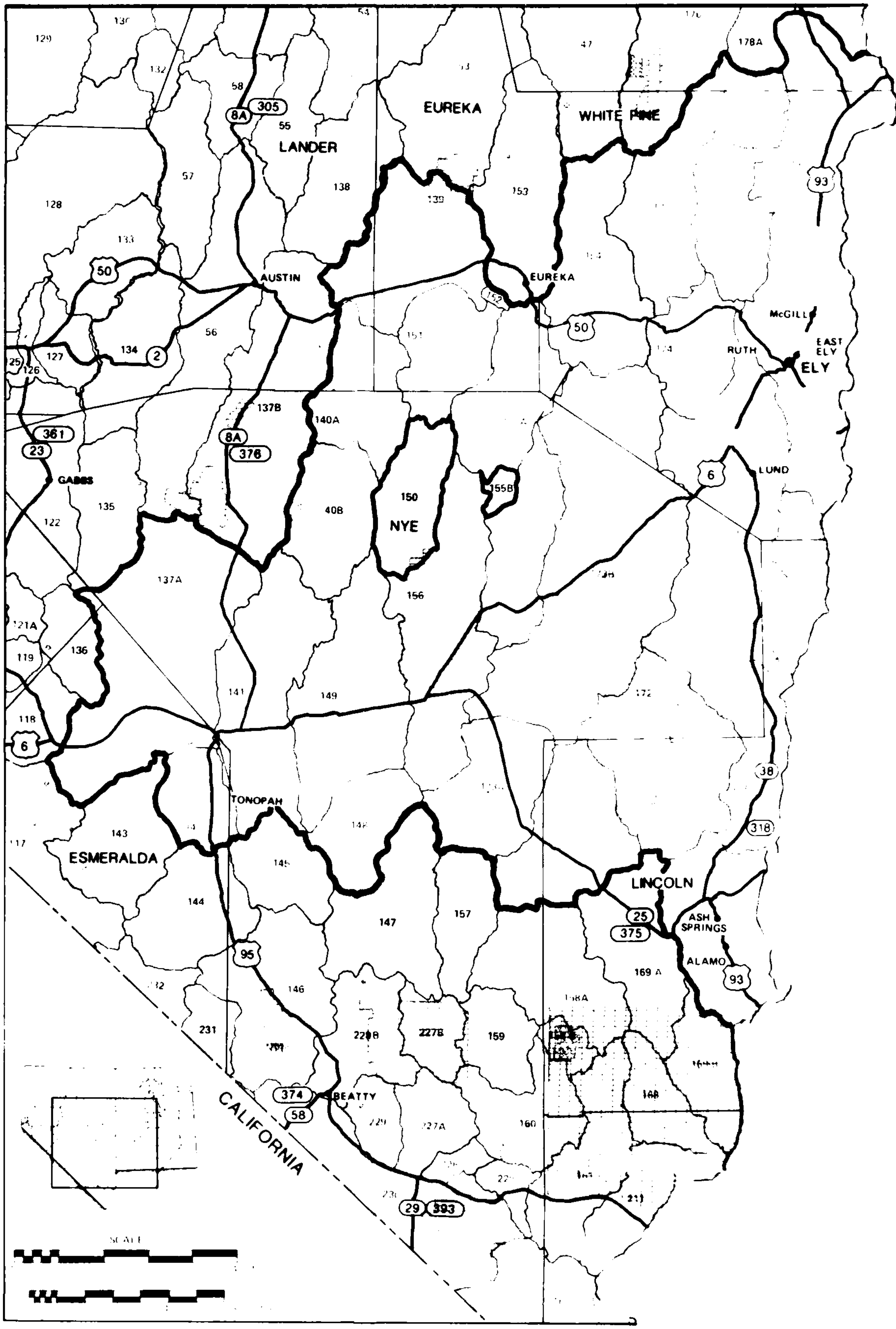


Figure 3.2.2.9-1. Wilderness resources in the Nevada/Utah study area. 4458 D



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ALAMO
BEATTY
CALIFORNIA
SCALE

4459-D

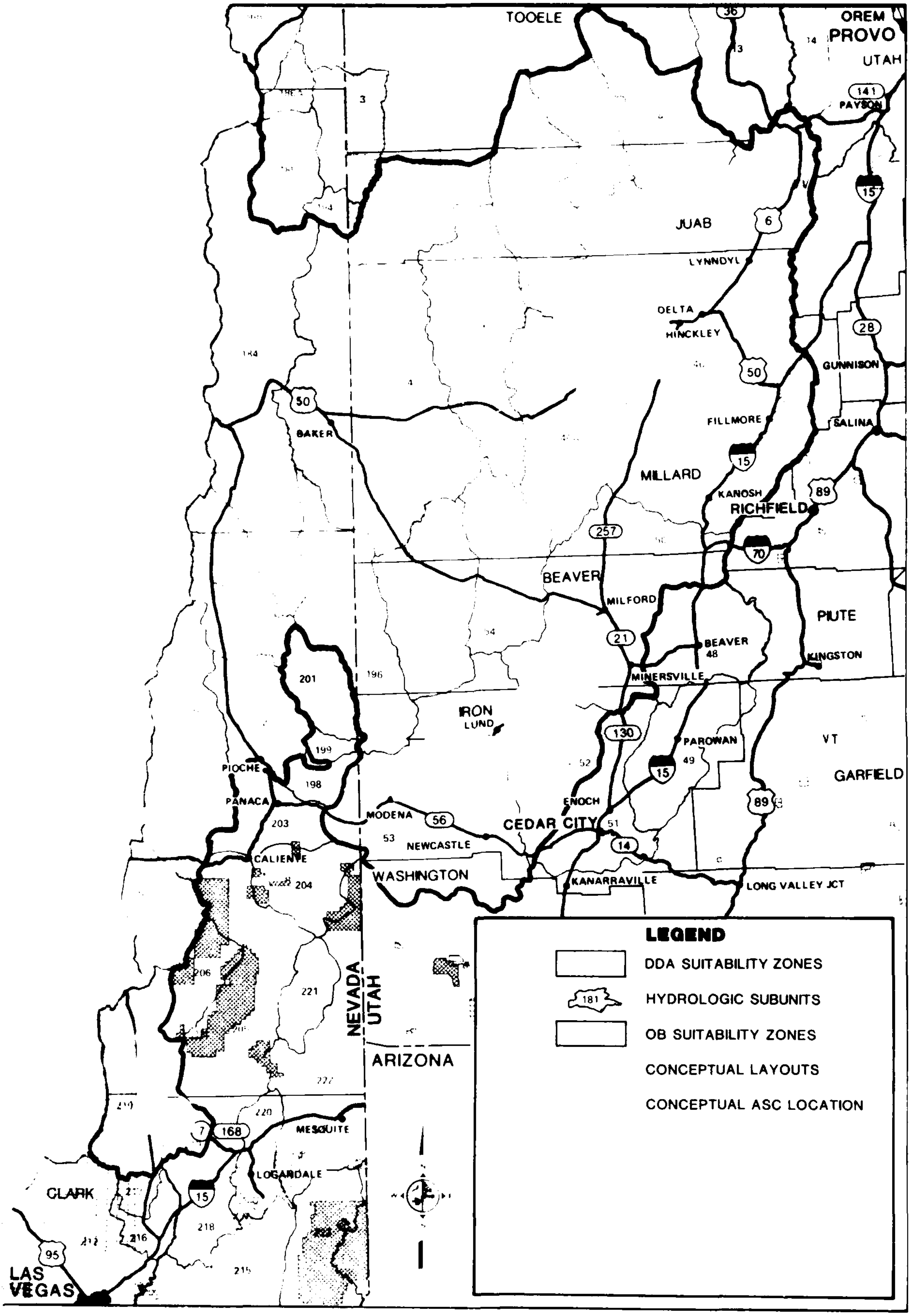
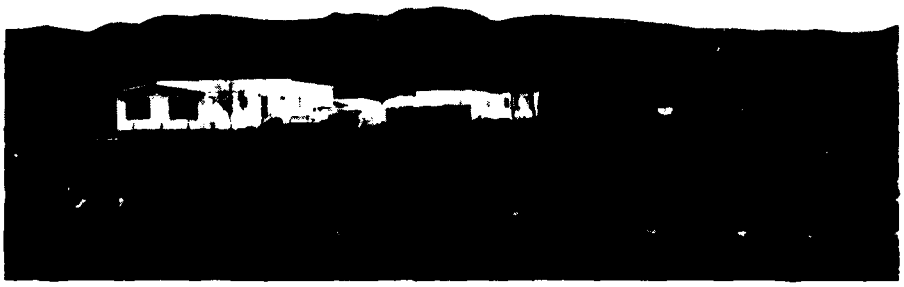
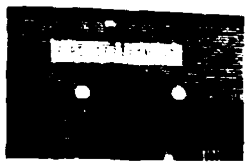


Figure 3.2.2.9-2. Significant natural areas in the Nevada/ Utah study area. 4458-D

Human Environment





HUMAN ENVIRONMENT

The following sections describe important social, economic, and cultural resources in the Nevada/Utah study area. The designated region of influence is shown in Figure 3.2.3-1.

Employment and Labor Force (3.2.3.1)

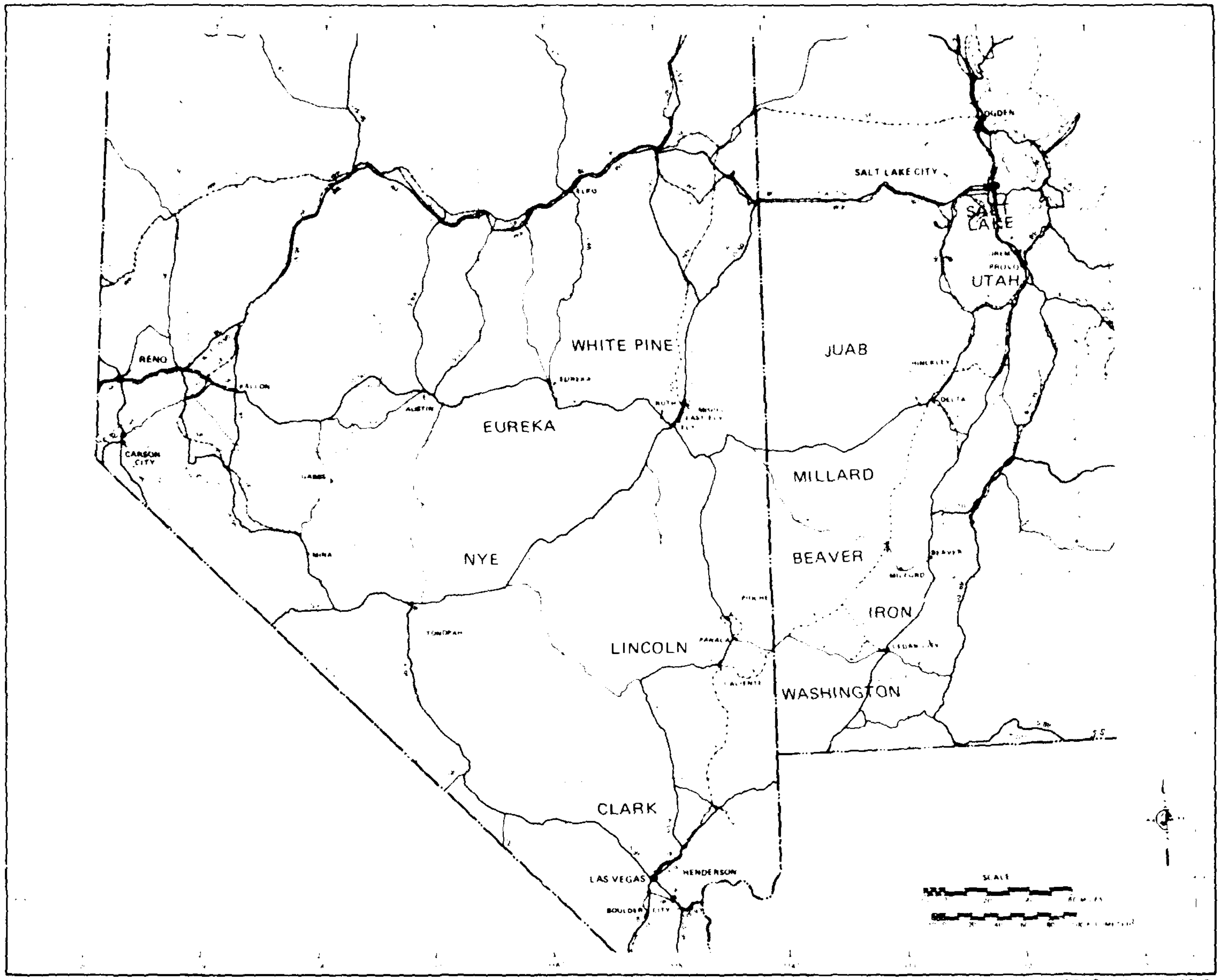
On the basis of a number of geotechnical and cultural criteria and military and operational suitability, two areas have been identified for M-X deployment. These are Nevada/Utah and Texas/New Mexico. This section deals with the Nevada/Utah region, which covers a large portion of central and eastern Nevada and western Utah. A detailed analysis of the employment and labor force in this region appears in Section 2.1.1 of ETR-44. The primary study area for socioeconomic analysis, called the region of influence (ROI), includes the Nevada counties of Clark, Eureka, Lincoln, Nye, and White Pine, and the Utah counties of Beaver, Iron, Juab, Millard, Salt Lake, Utah, and Washington. Potential base sites are located in the vicinities of Coyote Spring and Ely in Nevada, and Beryl, Delta, and Milford in Utah. Proposed construction camp sites are distributed across most of the counties in the ROI.

Recent Labor Force Trends (3.2.3.1.1)

Nevada (3.2.3.1.1.1)

The size of the employed and the unemployed labor force and the unemployment rate are useful measures of the study area economy, since they indicate the labor supply from which project-generated direct and indirect job demands can be filled. The Nevada ROI had a total labor force of 215,000 persons in 1980. Most of this labor force--208,000 persons--was located in Clark County, and represented 55 percent of the labor force of the entire state of Nevada. The other four counties in the Nevada ROI had a combined labor force of less than 7,500 persons in 1980, about 2 percent of the state total. The remaining portion of Nevada's labor force is located outside the Nevada ROI, mostly in the tourism centers of Reno and Tahoe South Shore and in Carson City, the state capital.

Tables presented in the baseline employment sections of ETRs 2C, 2D, 2G, 2I and 2L detail population, labor force, employment, unemployment, and unemploy



SOURCE: HDR SCIENCES, BASED ON INFORMATION FROM THE DEPARTMENT OF THE AIR FORCE, BMO (AFSC), AND OTHER STATE AND FEDERAL AGENCIES.

1918-C-2 1040-C

Figure 3.2.3-1. The Nevada/Utah region of influence (ROI) for the human environment.

ment rate fluctuations between 1968 and 1980 for Clark, Eureka, Lincoln, Nye, and White Pine counties, respectively. The Clark County labor force has more than doubled since 1968, and increased by 33 percent between 1975 and 1980. A major decrease in the White Pine County labor force occurred between 1975 and 1979 following the closure of large copper operations of the Kennecott Copper Corporation. Approximately 1,000 jobs were eliminated.

Employment levels increased between 1975 and 1980 in each of the ROI counties except White Pine. The number of employed persons in the five-county Nevada ROI was just over 200,000 in 1980, 96 percent of whom resided in Clark County.

The bulk of the unemployed were also located in Clark County, which had a slightly higher unemployment rate than that of Nevada as a whole. Unemployment rose sharply in 1975 to 16,600 persons or 10.6 percent of the labor force. Unemployment eased slightly during the next two years, and then dropped more than 3 percentage points in 1978 to 4.9 percent. In 1980, the number of unemployed rose sharply to 14,800, 7.1 percent of the labor force.

Unemployment rates in Eureka, Lincoln, and Nye counties have remained relatively low between 1975 and 1980, all averaging less than 5.5 percent. Unemployment in White Pine County, however, averaged 12.2 percent between 1975 and 1980 due to copper mining plant closures. In 1976, 950 people, comprising 23.5 percent of the county's labor force, were unemployed. By 1977, only 370 people, or 9.6 percent of the labor force, were unemployed because many of the workers that were laid off either found other jobs or left the county.

Unemployment rates in Clark and Lincoln counties through the first five months of 1981 increased over 1980 average levels--to 8.0 percent from 7.1 percent in Clark County, and to 3.8 percent from 3.2 percent in Lincoln County. Eureka, Nye, and White Pine counties experienced declines in unemployment rates through the first five months of 1981--in Eureka, from 5.0 to 2.4 percent, in Nye, from 3.8 to 3.5 percent, and in White Pine, from 7.6 to 6.9 percent (Nevada Employment Security Department). Declining unemployment in each of these three counties was accompanied by significant increases in the size of the labor force over 1980 levels. Eureka County's small labor force increased 3.9 percent through May 1981. The labor force in Nye County increased 7.6 percent, and in White Pine County, 8.0 percent. Additional detail on employment in these counties is provided in ETR-44.

The unemployed labor force is only a rough indicator of labor force availability. In particular, rapid employment growth is likely to induce in-migration of workers before the resident labor force is fully employed. At the same time, baseline unemployment would understate the local labor supply in cases where people are employed part-time but would prefer full-time employment, or when people not in the labor force might join it if suitable jobs became available. For the specific labor supply assumptions used in this analysis, see ETRs 27 and 44. However, for the rural Nevada counties, population totals are so small that no increase in resident labor force participation could meet projected M-X-induced demand.

Utah (3.2.3.1.1.2)

Salt Lake County's 286,000 workers comprised a large share--46 percent--of the Utah labor force in 1980. An additional 13 percent were located in Utah County

and the five remaining Utah ROI counties combined to represent 4 percent of the state total. The remaining 37 percent of the Utah labor force lived outside the ROI, mostly in Weber and Davis counties.

The baseline employment sections of ETRs 2B, 2E, 2F, 2H, 2J, and 2K include tables presenting population, labor force, employment, unemployment and unemployment rate fluctuations between 1968 and 1980 for Beaver, Iron, Juab, Millard, Salt Lake/Utah, and Washington counties, respectively.

Between 1968 and 1980, all Utah ROI counties except Beaver County have experienced an increase in the size of their resident labor forces. The most significant labor force increase occurred in Salt Lake and Utah counties. The labor force increased by 147,700, or 67.3 percent, over the 13-year period. This constitutes average annual growth of 4.4 percent. The combined labor force of the two counties, however, declined slightly between 1979 and 1980, the only decrease since 1968. Among the non-metropolitan counties, labor force growth was particularly rapid in Washington and Iron counties, at 6.1 and 4.0 percent per year, respectively. In Millard and Juab counties the labor force grew more slowly, at an average of 2.4 percent and 1.9 percent, respectively.

Employment of the labor force similarly increased from 1968-80 in all of the ROI counties except Beaver County. The most significant increase was in Salt Lake and Utah counties. Employment on a labor-force basis in Salt Lake and Utah counties declined by 1.3 percent from 1979 to 1980. Unemployment rose to 5.2 percent of the labor force, the highest level since 1977, but still lower than during most of the 1970s. The absolute number of unemployed persons reached 18,900 in 1980, the highest since 1975 when nearly 20,900 were out of work in the two counties. The Salt Lake/Utah unemployment rate of 5.2 percent was still well below the U.S. jobless rate of 7.1 percent in 1980. All of the counties in the Utah ROI averaged between 5.0 and 7.0 percent unemployment during the 1975 to 1980 period, generally lower than the 1975-80 national average of 7.0 percent. Only Juab County in the Utah ROI experienced average unemployment conditions as high as the recent national average.

Through the first half of 1981, seasonally adjusted six-month average unemployment rates in the state as a whole and in most of the Utah ROI counties exceeded the 1980 annual average levels (Utah Department of Employment Security, Employment Newsletter, selected issues, 1981). Unemployment increased to 5.8 and 5.5 percent from 5.1 and 5.4 percent in Salt Lake and Utah counties, respectively. Beaver County's unemployment rate had increased to 5.7 percent, while unemployment rose in Iron County to 6.9 percent and in Washington County to 5.7 percent. Only Juab and Millard counties in the Utah ROI experienced unemployment below 1980 average levels, with declines to 6.1 and 2.9 percent, respectively. State-level unemployment rose to 5.8 percent in the second quarter, largely as a result of continued weak performance of the U.S. economy as evidenced by a preliminary estimate of a 1.9 percent decline in real gross national product in the second quarter of 1981 (U.S. Department of Commerce, Bureau of Economic Analysis).

Projected Labor Force, Employment, and Unemployment without M-X (3.2.3.1.2)

Baseline Projections (3.2.3.1.2.1)

Recent trends in labor force, employment, and unemployment in the Nevada/Utah ROI counties have been projected to estimate economic conditions in these counties without M-X. These estimates have been made using the best available projections of population at the county level, published by the Nevada State Planning Coordinators Office and the Bureau of Economic and Business Research of the University of Utah. County data on labor force and unemployment from 1975-80 are then used to derive probable trends from these projections in baseline labor force, employment, and unemployment conditions.

Average labor force participation rates and unemployment rates for each of the counties in the Nevada/Utah ROI for the period 1975-80 are presented in the "Projected Labor Force, Employment and Unemployment without M-X" (2.1.1.4) section of ETR-44. The labor force participation rate is the percentage of the total population which is in the labor force (those persons either employed or actively seeking work). The unemployment rate is the share of the labor force which is not employed. The assumption is made that the recent average behavior of these county-level measures is the best guide to their average future levels. Significant variation may occur from year to year, but the long-term behavior of these rates is assumed to fluctuate around this average. An average based on a longer time series has been rejected in this analysis to best capture the effects of long-term changes in the demographic composition of the labor force which became most noticeable nation-wide since the early 1970s.

Both participation rates and unemployment rates show significant variation from one county to another within the region. While 46.1 percent of the region's total population is in the labor force, participation rates vary from a low of 30.7 percent in Nye County to a high of 54.2 percent in Eureka County. The major metropolitan areas in the ROI--Salt Lake/Utah and Clark counties--have recent average participation rates of 45.8 and 47.8, respectively.

The region's unemployment rate during the period 1975-80 averaged 6.1 percent of the labor force. At the county level, average unemployment rates for 1975-80 varied from 3.5 percent in Eureka County to 12.2 percent in White Pine County. The White Pine County unemployment rate displayed in ETR-44 has been adjusted to exclude the unusually high unemployment levels in 1976 due to the closing of the Kennecott copper operations. The projected unemployment rate for White Pine County is 9.1 percent, based on data from 1974 through 1980, excluding the high unemployment year of 1976. Clark County's unemployment rate averaged 7.7 percent of the labor force during 1975-80, above the national average of 7.0 percent during this period. Unemployment in Salt Lake/Utah counties is assumed to average 5.2 percent. Clark County's unemployment rate is assumed to decline slightly after 1990, consistent with assumptions made by the Section 208 planning projections for Clark County (Clark County Board of Commissioners, Clark County 208 Water Quality Management Plan, Growth Forecasts, November 1977, p. 46).

County-level population projections (see ETR-27), labor force participation rates, and unemployment rates are used to project employment by place of residence using the labor force concept for each of the ROI counties from 1982

through 1994. These projections of regional employment, without M-X, are presented in Table 3.2.3-1 for Baseline 1, or "trend-growth" conditions, and in Table 3.2.3-2 for Baseline 2, or "high-growth" conditions. The trend-growth baseline projection represents a continuation of 1967-78 trends in the region. The high-growth projections include specific projects which are large relative to the local economies in which they would be constructed. These projections are presented through 1994--five years after construction of the M-X basing system would be complete and fully operational.

Under Baseline 1 (trend-growth) conditions, employment in the 12-county Nevada/Utah ROI is projected to grow from 631,000 in 1982 to 871,000 in 1994. This represents average annual growth of 2.7 percent. Clark County is projected to lead the region in growth, from 219,000 jobs in 1982 to 331,000 jobs in 1994, or about 3.5 percent per year. Salt Lake and Utah counties are expected to grow more slowly at approximately 2.3 percent annually. Among the more rural counties in the ROI, Iron and Washington counties are the two largest local job centers. Employment in these counties is projected to grow at a 2.4 percent annual rate for Iron County and a 2.9 percent rate for Washington County. Employment in Millard, Juab, Nye, and Lincoln counties is projected to increase at annual rates of 2.2, 2.5, 2.9, and 3.0 percent, respectively. More modest growth is projected for Eureka and Beaver counties--about 1.7 and 1.4 percent respectively. No significant growth is projected for White Pine County throughout this period under trend-growth conditions.

Table 3.2.3-2 presents Baseline 2, or high-growth employment projections, for the Nevada/Utah ROI from 1982 through 1994. Over the long term, the high-growth projections for the region as a whole differ very little from the trend-growth projections in Table 3.2.3-1. The long-term (1994) difference between the two projections is only 8,000 jobs. Differences between the two projections are larger during the years 1985 through 1988. During these years, the high-growth projections are approximately 11,000 to 12,000 jobs higher than the trend-growth projections.

The biggest differences between the two sets of baseline projections occur at the county level. The differences in assumptions that underlie these two sets of baseline projections are sufficient to significantly change the employment projections for four counties: Beaver, White Pine, Millard, and Juab. In Beaver County, the high-growth projection of 5,030 jobs in 1986 exceeds the trend-growth projection of 2,147 jobs in that same year by 134 percent. In White Pine County, the high-growth projection for 1987 of 5,829 jobs is 94 percent larger than the 3,000 jobs projected under trend-growth conditions. In Millard County in 1985, the high-growth projection of 7,177 jobs exceeds the trend-growth projection of 4,188 jobs by 71 percent. In Juab County, the high-growth projection of 3,376 jobs in 1987 exceeds the trend-growth projection of 2,574 jobs by 31 percent. In addition, in Salt Lake and Utah counties, up to 3,000 jobs indirectly associated with higher growth in the rural counties are created during 1985-88. For the remaining counties, differences between the two sets of projections are very slight. Table 3.2.3-3 summarizes the principal differences between the two alternative projections.

Only slight changes are forecast in sectoral employment shares over the projection period. Only the share of total ROI employment in government is forecast to decline by more than 1 percent over the 1980-1995 period and only services' percent share is projected to increase by more than one percent.

Table 3.2.3-1.

BASELINE 1 TREND-GROWTH EMPLOYMENT PROJECTIONS, NEVADA/UTAH ROI, 1982-1994

COUNTY	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
BEAVER	1955.	2006	2062	2120.	2147.	2167.	2186.	2206.	2224.	2249.	2274.	2297.	2316.
CLARK	218558	226313	234342	242657.	251970.	261646.	271687.	282122.	292948.	302099.	311526.	321252.	331276.
EUREKA	644	656	668.	681.	690.	701.	717.	727.	743.	753.	764.	779.	790.
IRON	7623	7864	8136.	8425.	8637.	8838.	9047.	9262.	9479.	9653.	9832.	10005.	10167.
JUAB	2147.	2243	2350.	2466.	2522.	2574.	2630.	2684.	2739.	2780.	2820.	2858.	2892.
LINCOLN	1690.	1741.	1793.	1847.	1900.	1956.	2017.	2077.	2137.	2202.	2271.	2335.	2409.
MILLARD	3678.	3834	4004	4188	4285.	4377.	4473.	4568.	4663.	4703.	4739.	4772.	4796.
NYE	2883.	2983.	3082	3182.	3275.	3372.	3470.	3573.	3679.	3773.	3868.	3968.	4068.
SALT LAKE/UTAH	380370	394230	409410.	425805.	434985	443241.	451975.	460343.	468541.	476205.	483719.	490687.	497004.
WASHINGTON	8594	8955	9330	9721.	9989.	10263.	10545.	10835.	11133.	11363.	11597.	11837.	12081.
WHITE PINE	2983.	2987.	2991	2995.	2996.	3000.	3003.	3011.	3014.	3018.	3022.	3025.	3029.
DEPLOYMENT REGION	631124.	653811	678167	704087.	723397.	742134.	761749.	781406.	801301.	818798.	836431.	853815.	870827.

SOURCE HDR SCIENCES, BASED ON POPULATION, LABOR FORCE, AND UNEMPLOYMENT DATA FROM STATE SOURCES. CT

Table 3.2.3-2.

BASELINE2 HIGH-GROWTH EMPLOYMENT PROJECTIONS, NEVADA/UTAH ROI, 1982-1994.

COUNTY	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
BEAVER	2749.	3637.	4129.	4615.	5030.	4207.	4078.	4120.	4183.	4252.	4320.	4389.	4435.
CLARK	218648.	226470.	234582.	243086.	252471.	262152.	272152.	282504.	293277.	302446.	311888.	321631.	331670.
EUREKA	644.	656.	668.	681.	691.	701.	717.	727.	743.	753.	764.	779.	790.
IRON	7638.	7894.	8179.	8488.	8709.	8901.	9105.	9313.	9525.	9700.	9881.	10053.	10217.
JUAB	2340.	2757.	3056.	3321.	3321.	3376.	3341.	3206.	2995.	3041.	3088.	3132.	3168.
LINCOLN	1690.	1742.	1794.	1849.	1903.	1959.	2019.	2079.	2139.	2203.	2273.	2338.	2411.
MILLARD	4556.	4851.	6065.	7177.	7079.	7226.	7024.	6179.	5712.	5768.	5832.	5888.	5936.
NYE	2883.	2983.	3083.	3184.	3277.	3374.	3471.	3574.	3680.	3775.	3870.	3970.	4070.
SALT LAKE/UTAH	380987.	395316.	411126.	428593.	438073.	446371.	454834.	462602.	470371.	478129.	485730.	492763.	499181.
WASHINGTON	8594.	8955.	9330.	9721.	9989.	10263.	10545.	10835.	11133.	11363.	11597.	11837.	12081.
WHITE PINE	2984.	2989.	3073.	4575.	5152.	5829.	5563.	4985.	4598.	4644.	4697.	4732.	4778.
DEPLOYMENT REGION	633712.	658249.	685084.	715289.	735694.	754359.	772848.	790124.	808356.	826075.	843939.	861511.	878737.

SOURCE HDR SCIENCES, BASED ON POPULATION, LABOR FORCE, AND UNEMPLOYMENT DATA FROM STATE SOURCES. SEE TEXT. CT

Table 3.2.3-3. Difference between trend-growth and high-growth baseline employment projections, selected Nevada/Utah ROI counties, 1982-94 (number of employed persons).

Year	Beaver County	Juab County	Millard County	White Pine County	Other Counties[1]	Nevada/Utah ROI Total
1982	794	193	878	1	722	2,588
1983	1,631	514	1,018	2	1,274	4,439
1984	2,066	/06	2,061	82	2,002	6,917
1985	2,495	855	2,989	1,580	3,284	11,203
1986	2,883	799	2,794	2,156	3,667	12,299
1987	2,041	802	2,849	2,829	3,704	12.225
1988	1,892	711	2,552	2,560	3,385	11,100
1989	1,914	522	1,611	1,974	2,695	8,716
1990	1,959	256	1,049	1,584	2,208	7,056
1991	2,003	261	1,065	1,626	2,321	7,276
1992	2,046	267	1,093	1,675	2,425	7,506
1993	2,092	274	1,117	1,707	2,508	7,698
1994	2,120	276	1,140	1,749	2,625	7,910

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[1]Primarily Salt Lake and Utah counties, indirectly associated with developments in the four counties shown.

Source: HDR Sciences calculations, based on population, labor force, and unemployment data from Nevada Employment Security Department and Utah Department of Employment Security.

Major Non-M-X Developments in the Nevada/Utah ROI (3.2.3.1.2.2)

The differences between Baselines 1 and 2 are attributable to the inclusion of a number of projects in Baseline 2. These projects are primarily mineral extraction and processing and electrical energy production. High oil prices have encouraged the search for substitute fuels and technologies. In the study area, power plants using coal and, to a lesser extent, geothermal steam are the major anticipated energy production activities. Molybdenum and alunite mining also are potentially important within the ROI.

The Bureau of Economic and Business Research of the University of Utah, in consultation with the Nevada and Utah State Planning Coordinators Offices, has recommended that Baseline 1 (trend growth) specifically include:

- continuation of 1967-1978 growth trends;
- construction of Anaconda Nevada Molybdenum Project (Nye County);
- metal mining in Eureka and White Pine counties;
- expansion of oil and gas activity; and
- mineral exploration in the Utah portion of the ROI.

(See University of Utah, Bureau of Economic and Business Research, "Refinement of Broad Area Impacts of M-X Missile Deployment on Nevada and Utah and Preliminary Allocation of Impacts to Community Group Level," August 13, 1980, pp. 2-3.)

Baseline 2 (high growth) specifically includes the following developments:

- all the trend-growth activities of Baseline 1;
- in White Pine County, the White Pine Power Project;
- in Millard County:
  - Intermountain Power Project;
  - Continental Lime cement plant;
  - Brush Beryllium expansion;
  - Precision-Built Modular Homes;
- in Juab County:
  - Martin-Marietta cement plant;
  - General Battery;
  - UFCO coal loading facility; and
- in Beaver County:
  - geothermal power development;
  - molybdenum mining;
  - alunite mining and processing.

There is a degree of uncertainty regarding each of these Baseline 2 projects, though some may be more likely than others.

Other projects not assessed in this analysis include the following:

- Allen-Warner Valley complex, including the following facilities:
  - Alton mine, southern Utah;
  - Warner Valley Power Plant, St. George, Utah;
  - Allen Power Plant, Clark County, Nevada;
  - coal slurry lines from mine to plants;

transmission lines from plants to southern California;

- o Rocky Mountain Pipeline, 1985;
- o Cove Fort Geothermal Power Plant, Millard County, Utah;
- o Reid Gardner Power Plant #4, Clark County, Nevada;
- o Mountain Fuel Coal Gasification Plant;
- o Valmy Power Plant, Valmy, Nevada; and
- o Mormon Mesa Solar Power Plant.

These projects did not receive treatment because a) their effects on employment were expected to be small, b) their probability of realization was deemed relatively low, or c) their principal effects were likely to occur outside the Nevada/Utah ROI.

In Beaver County, the Pine Grove Molybdenum Project is the primary source of the differences between Baseline 1 and Baseline 2. This molybdenum mining and milling development accounts for about 90 percent of the difference in jobs between Baseline 2 and Baseline 1 from 1982 through 1986, and about 40 percent thereafter. Alunite mining and processing account for about 60 percent of the difference between the two baselines after 1986. The Roosevelt Hot Springs geothermal project accounts for about 5-10 percent of the difference throughout the projection period.

The principal cause of the differences between trend-growth and high-growth projections in Millard County is the Intermountain Power Project. It accounts for about 80 percent of the difference between the two baselines after 1984. The Martin Marietta cement plant in Juab County is the primary reason for the difference between the two baselines in 1982-83, and accounts for about 15 percent of the difference during the rest of the period.

Comparison of Alternative Projections (3.2.3.1.2.3)

In order to evaluate the baseline projections in Tables 3.2.3-1 and 3.2.3-2, it is useful to compare these projections to alternative employment projections available for the ROI counties and states. Two such projections are (1) projections by the University of Utah's Bureau of Economic and Business Research (BEBR), and (2) projections by Chase Econometrics.

The BEBR-developed employment projections for the Nevada/Utah ROI were used to derive the population projections used in this analysis. Because the BEBR projections were done on an establishment basis rather than a labor force basis, it was not possible to directly include the BEBR employment projections here. The trend-growth projections used in this analysis are based on the BEBR population projections for Utah and therefore indirectly on the BEBR employment projections. This analysis assumes average annual employment growth of 3.7 percent from 1982-85, of 2.6 percent from 1985 through 1990, and of 2.1 percent for 1990 through 1994. By comparison, the BEBR employment projections indicate an average rate of 3.9 percent per year employment growth from 1980 through 1985, of 2.2 percent for 1985-90, and of 2.0 percent for 1990-95. In other words, employment projections used in this analysis assume slightly slower growth in the near term than the BEBR projection and slightly more rapid growth after 1985.

Under high-growth conditions, projections used in this analysis indicate average growth of 4.1 percent per annum for 1982 through 1985, 2.5 percent per

year for 1985 through 1990, and 2.1 percent per year from 1990 through 1994. By comparison, the high-growth scenario developed by BEBR indicates 4.3 percent employment growth for 1980 through 1985, 2.0 percent employment growth for 1985-90, and 2.0 percent for 1990-95. As with the trend-growth baseline projections, employment assumptions included in this analysis indicate somewhat slower employment growth under baseline conditions for the near term and somewhat more rapid baseline employment growth beyond 1985.

Chase Econometrics forecasts employment growth for the state of Nevada of 4.5 percent per year for 1980 through 1985, and 4.6 percent per year from 1985 through 1990 (Chase Econometrics long-term regional forecasts, first quarter 1981). Utah's employment is projected by Chase to increase 2.8 percent annually from 1980 through 1985, and 3.8 percent annually from 1985 through 1990. For the two state economies combined, these projections represent employment growth of 3.5 percent annually from 1980 through 1985, and 4.1 percent annual growth from 1985 through 1990. The major difference between the Chase projections and those used in this analysis as well as those of BEBR occur in the employment projections beyond 1985. The Chase projection of 4.1 percent annual employment growth is twice as large as the BEBR projection of 2.0 percent annual employment growth. The Chase projection is about 1.5 percentage points per year greater than the projections used in this analysis.

Nevada/Utah employment growth rate without M-X is projected to be considerably higher than recent historical growth and higher than projected future growth for the United States as a whole. U.S. employment, on a labor force basis, grew at an average rate of 2.2 percent annually from 1970 through 1980 (Council of Economic Advisors, Economic Report of the President, Washington, D.C., January 1981, p. 264). By comparison, employment on a labor force basis in the 12-county Nevada/Utah ROI grew at an average rate of 4.9 percent--twice as fast as the U.S.--during the same period.

Projections for the U.S. economy by Chase Econometrics indicate an average employment growth rate of 2.3 percent annually for 1980-85 and of 1.8 percent for 1985-90. The growth advantage of the Nevada/Utah ROI during 1970-80 therefore is projected to continue, though the difference between ROI growth and U.S. growth is likely to be less than has recently been the case. Moreover, the difference between employment growth in the ROI and in the rest of the United States is projected to narrow after 1985.

Table 3.2.3-4 summarizes comparisons of the alternative employment projections.

While projected employment growth without M-X for the Nevada/Utah ROI and many of its counties is rapid compared to U.S. standards, it is representative of employment conditions throughout much of the western United States during the 1970s (Nevada National Bank, Western Economic Overview), 1970-77). This growth also is occurring on a very small economic base compared to states and areas elsewhere within the United States. The Nevada/Utah ROI, even with rapid growth, will remain more sparsely developed than most of the United States.

Table 3.2.3-4. Projected average annual employment growth rates, Nevada/Utah ROI, Nevada/Utah two-state area, and United States (percent).

	1970-80	1980-85	1985-90	1990-95
EIS[1]				
Trend-growth	4.9	3.7	2.6	2.1
High-growth	4.9	4.1	2.5	2.1
BEBR				
Trend-growth	4.9	3.9	2.2	2.0
High-growth	4.9	4.3	2.0	2.0
Chase				
Two-state area	4.7	3.5	4.1	n.a.
United States	2.2	2.3	1.8	n.a.

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[1] For EIS projections, averages are for 1982-85, 1985-90, 1990-94.

Source: For EIS projections, HDR Sciences calculations, based on data provided by the University of Utah, Bureau of Business and Economic Research, the Nevada Employment Security Department and the Utah Department of Employment Security; for BEBR projections, the University of Utah, Bureau of Business and Economic Research; for Chase Econometrics projections, the Chase regional long-term forecast of first quarter 1981, and the U.S. long-term standard-trend forecast of second quarter 1981.

Income and Earnings (3.2.3.2)

Income accruing to residents of an area can come from several sources: wage and salary disbursements, other labor income, proprietor income, dividends, interest, rental income, and transfer payments. Wages and salaries are generally the principal sources of income. When combined with proprietor income and other labor income, this is termed "total labor and proprietor income by place of work," or total earnings. Transfer payments (social security payments, federal old-age, survivors, disability, and hospital insurance payments, state unemployment insurance payments, government retirement payments, and other government programs) and property-type income (dividends, interest, and rental income) make up the other major income sources. Total personal income and personal income per capita are both widely-used measures of the economic well-being of a local population.

The following sections present historic earnings and income data for the Nevada/Utah ROI counties. Unless otherwise indicated, all dollar amounts are in current dollars. Constant-dollar estimates were calculated using the implicit price deflator for personal consumption expenditures. Detailed data tables presenting earnings by major industrial sector, as well as total personal income, for the ROI counties, as well as the states as a whole, can be found in the baseline earnings sections of Environmental Technical Report Numbers 2A-2L. These data are obtained from the Regional Economic Information System maintained by the Bureau of Economic Analysis of the U.S. Department of Commerce and are available for the 1967-1979 period.

Nevada

Total earnings in Nevada amounted to approximately $6 billion in 1979. The Nevada economy is dominated by the services industry (principally due to the importance of the state's gaming and tourist industries), which accounted for 37.3 percent of total earnings in 1979. This is more than twice the 1979 national average of 17.1 percent. Total personal income was approximately $7.4 billion in 1979, which was more than double the 1974 level of $3.5 billion. The 1974-1979 increase represented an annual average growth rate of 16.2 percent. This is approximately 50 percent greater than that of the United States. Much of this growth has been in the construction sector (20.5 percent annually over the 1974-79 time period).

Income received through transfer payments and other income sources (dividends, interest, and rental income) accounted for 11.3 percent and 13.2 percent of total personal income respectively in 1979, compared to the U.S. average of 13.0 percent and 14.1 pecent in the same year.

Personal income per capita for selected counties in the DDA are presented in Table 3.2.3.2-1. Clark County establishes the general trend for the state with a 1979 per capita income of $10,266, compared to the state level of $10,201. These levels are significantly higher than the U.S. average of $8,757. With the exception of White Pine County, 1979 per capita income in the rural counties compared favorably to the U.S. average. However, pre-1978 per capita rates for the rural Nevada counties shown in Table 3.2.3.2-1 were lower than both the state and U.S. averages which indicates relatively low-income and less-developed economies. The relatively high 1979 rates in Eureka and Nye counties must be viewed with caution, as they over-state historical per capita income. These areas have relatively small

Table 3.2.3.2-1. Personal income per capita, selected Nevada counties, state of Nevada, and United States, 1969-1979 (current dollars).

County	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Clark	4,247	4,591	4,774	5,108	5,594	5,979	6,545	7,176	8,083	9,208	10,266
Eureka	4,746	4,065	4,096	4,630	4,105	3,805	4,180	5,287	6,683	7,640	9,845
Lincoln	2,731	2,879	3,312	3,742	3,953	4,048	4,511	4,589	5,124	6,119	7,619
Nye	3,994	3,911	4,524	4,719	4,576	3,559	5,071	5,413	6,218	8,560	9,566
White Pine	3,314	3,700	3,896	4,310	4,769	5,072	5,353	5,174	6,402	7,109	7,032
Nevada	4,249	4,625	4,853	5,251	5,720	6,064	6,635	7,317	8,272	9,343	10,201
United States	3,667	3,893	4,132	4,493	4,981	5,428	5,861	6,401	7,035	7,846	8,757

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Sources: For aggregate personal income, U.S. Department of Commerce Bureau of Economic Analysis, Regional Economic Information System, April 1981; and for population, Nevada State Planning Coordinators Office.

and undiversified economic bases dominated by mining and grazing (though the services sector is quite strong in Nye County), thus year-to-year fluctuations may be substantial.

Per capita income is used to estimate the average relative well-being of residents within a county. Earnings-per-worker statistics are used to measure average wages in a county. Table 3.2.3.2-2 provides selected wage and salary earnings-per-worker data for ROI counties in Nevada, and for the state and the United States. As with per capita income rates, wage and salary earnings-per-worker in Nevada were higher--$13,111 per worker--than the U.S. average of $12,884 per worker in 1979. Rates in most counties closely follow the state average. A notable exception is the rate in Nye County--$18,000 per worker, or about one third higher than the state average.

While apparent wage and salary earnings-per-worker rates showed continued steady growth during 1974-79 in all the counties, after adjusting for inflation, very little real growth occurred.

Aggregate personal income for the state of Nevada is projected to increase in real terms at an average annual rate of 3.2 percent from 1980 to 1985, and at 3.9 percent from 1985 to 1990 (Chase Econometric Associations, Inc., first quarter 1981). By comparison, U.S. personal income is projected by Chase to grow at only two-thirds this rate; 2.4 percent annually during 1980-85 and 2.6 percent annually during 1985-90.

Utah

Total earnings in Utah were approximately $8 billion in 1979. Utah earnings represented approximately 0.5 percent of the U.S. total, up slightly since 1974. Much of this increase can be attributed to above-average gains in the mining, construction, and manufacturing sectors.

Per capita income for selected Utah counties and the state of Utah are presented in Table 3.2.3.2-3. Per capita incomes for all the counties, as well as the state, were substantially lower in 1979 than the U.S. average of $8,757. Per capita incomes ranged from $5,111 in Juab County in 1979 to $8,275 in Salt Lake County. Salt Lake and Utah counties enjoy higher per capita incomes, principally due to their diversified economic bases.

Table 3.2.3.2-4 presents wage and salary earnings-per-worker for the ROI counties, the state of Utah, and the United States. Earnings per worker in the ROI counties fall below the state and U.S. averages except in Salt Lake County.

When adjusted for inflation, Utah's historic wage and salary earnings per worker rates indicate only modest gains, from $11,131 in 1974 to $11,951 by 1979, an average real gain of only 1.4 percent annually.

Projections by Chase Econometrics indicate average annual growth of 3.2 percent in real aggregate personal income from 1980 to 1985, and 3.4 percent from 1985 to 1990. By comparison, Chase's projections of U.S. personal income growth are significantly less, 2.4 percent during 1980-85 and 2.6 percent from 1985-90.

Table 3.2.3.2-2. Wage and salary earnings per worker, selected counties, State of Nevada, and United States, 1974-1979 (current dollars).

County	1974	1975	1976	1977	1978	1979
Clark	9,734	10,318	10,935	11,583	12,538	13,361
Eureka	9,257	10,127	10,852	11,763	13,004	14,907
Lincoln	8,589	9,243	9,470	10,340	11,860	13,097
Nye	13,853	14,989	15,390	16,136	17,764	17,994
White Pine	9,176	9,823	10,133	10,704	11,340	11,827
Nevada	9,386	9,978	10,594	11,280	12,192	13,111
United States	8,909	9,572	10,283	10,986	11,855	12,884

F5196/9-2-81

Source: U.S. Department of Commerce Bureau of Economic Analysis, Regional Economic Information System, April 1981.

Both Nevada's and Utah's economies are projected to remain strong through the next decade. The average annual growth in real personal income for both states is projected to be from 30 to 50 percent better than the nation's. Workers such as these in Las Vegas are expected to enjoy a continued standard of living.

Table 3.2.3.2-3. Personal income per capita, selected Utah counties, State of Utah, and United States, 1969-1979 (current dollars).

County	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Beaver	2,300	2,571	3,006	3,098	3,476	3,735	3,868	4,439	4,683	5,287	5,563
Iron	2,591	2,614	2,912	3,178	3,477	3,668	3,906	4,210	4,445	5,004	5,358
Juab	2,188	2,314	2,525	2,776	2,983	3,073	3,227	3,492	3,702	4,370	5,111
Millard	2,511	2,547	2,921	3,101	3,628	3,717	3,873	4,109	4,162	4,960	5,088
Salt Lake	3,227	3,555	3,827	4,189	4,626	5,057	5,577	6,014	6,850	7,633	8,275
Utah	2,333	2,498	2,662	2,940	3,328	3,640	3,921	4,355	4,908	5,278	5,805
Washington	2,115	2,400	2,510	2,691	3,169	3,381	3,802	4,149	4,607	5,123	5,506
State of Utah	3,088	3,168	3,422	3,710	4,096	4,463	4,902	5,379	5,946	6,580	7,183
United States	3,667	3,893	4,132	4,493	4,981	5,428	5,861	6,401	7,035	7,846	8,757

T5107/9-2-81

Sources: For aggregate personal income, U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, April 1981; and for population, Utah State Population Work Committee.

Table 3.2.3.2-4. Wage and salary earnings per worker, selected Utah counties, State of Utah, and United States, 1974-1979 (current dollars).

County	1974	1975	1976	1977	1978	1979
Beaver	6,158	6,415	6,862	7,485	8,131	9,540
Iron	6,203	6,609	7,234	8,100	9,016	9,876
Juab	5,908	6,193	6,407	6,623	7,269	9,702
Millard	5,413	5,903	5,898	6,177	6,787	8,231
Salt Lake	8,161	8,825	9,558	10,385	11,286	12,340
Tooele	10,026	10,839	11,889	12,742	13,009	14,061
Utah	7,478	8,258	9,030	9,685	10,422	11,564
Washington	5,790	6,324	6,820	7,414	8,118	9,297
State of Utah	7,976	8,639	9,364	10,104	10,914	11,951
United States	8,909	9,572	10,283	10,986	11,855	12,884

T5108/9-2-81

Source: U.S. Deptartment of Commerce, Bureau of Economic Analysis, Regional Economic Information System, April 1981.

Public Finance (3.2.3.3)

Nevada

Nevada's major revenues are derived from taxes on sales, use, and gaming. These account for over three-quarters of the state's general fund revenues. In Utah, sales and income taxes account for nearly three-fourths of the total revenues. For both states, the largest expenditure is for education, about 60 percent of the total in Nevada, and 40 percent in Utah. These are followed by expenditures on social services in both status, then public safety in Nevada, and highway expenditures in Utah.

Historical general fund revenues and appropriations for Nevada are presented in Tables 3.2.3.3-1 and 3.2.3.3-2. Revenues accruing to the general fund grew at an annual average rate of 20.1 percent between 1975-76 and 1979-80. This increase was distributed among the major revenue sources; sales and use tax collections, and state gaming revenues. While the state can expect continued growth in overall revenue levels, Nevada's revenue structure has recently undergone significant changes. Legislation effective July 1, 1979 abolished the state property tax as well as sales tax levies on non-restaurant food items. The 1981 Nevada Tax Reform Plan, in an effort to offset decreased property tax revenues, raised the sales tax rate to 5.75 percent (effective May 1, 1981). As a result of these tax reforms, Nevada's revenue base has become much more dependent on gaming and tourist-related activities.

General fund appropriations grew at an annual average rate of 13.7 percent between 1976-77 and 1980-81 (see Table 3.2.3.3-2). Much of this increase is accounted for by average annual growth of 21.6 percent in education appropriations, which account for about 60 percent of total general fund appropriations. Human resource outlays, such as health and welfare, account for the other major appropriations category (19.6 percent of the total in 1980-81).

State net general fund operating expenditure data for Nevada are presented in Table 3.2.3.3-3. This information differs from Table 3.2.3.3-2 in two ways: first, these are actual expenditures rather than appropriations; second, these data have been adjusted for such items as double counts, reversions and intergovernmental transfers. The estimates represent net expenditures and therefore are considerably, less than the corresponding appropriations figures. Total net operating expenditures and education expenditures are 84.9 percent and 88.7 percent as great as the corresponding appropriations for FY 79-80.

Utah

Tables 3.2.3.3-4 and 3.2.3.3-5 present revenues and expenditures for the state of Utah. Total revenues amounted to $1.4 billion in 1979-80 and grew at an average annual rate of 18.4 percent between 1974-75 and 1979-80. In 1979-80, general sales tax revenues accounted for 22.8 percent of total state revenues. Another major revenue source, individual income taxes, comprised 18.8 percent of the total. Federal aid was the largest single revenue source in 1979-80 at 31 percent of total state revenues.

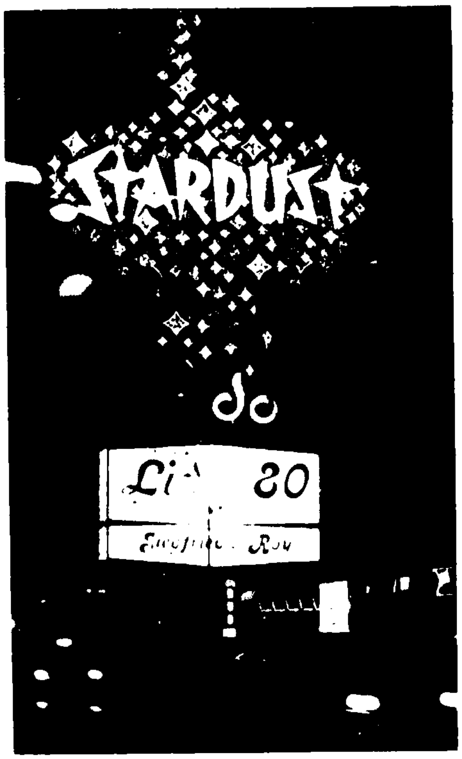
State of Utah expenditures totaled approximately $1.2 billion in 1978-79 representing an annual average rate of growth of 15.6 percent between 1974-75 and

Table 3.2.3.3-1. Summary of General Fund Revenues, State of Nevada, 1975-76 through 1979-80 (thousands of dollars).

Revenue Source	1975-76	1976-77	1977-78	1978-79	1979-80
Taxes					
Property tax	8,359.2	9,137.3	10,287.7	10,954.6	191.3
Sales and use tax	65 823.6	77,020.0	95,197.9	16,459.2	122,008.7
Gaming (state)	67,174.7	74,937.3	90,873.2	111,902.9	127,537.0
Other	27,618.3	31,915.7	86,497.1	141,950.7	41,161.3
Subtotal taxes	168,975.8	193,010.3	232,855.9	280,907.4	290,898.3
Licenses	2,283.4	2,670.4	4,009.7	4,080.5	4,691.5
Fines and fees	510.1	606.9	583.9	600.1	1,551.1
Charges and services	676.9	653.8	442.0	645.4	139.8
Interest on bank deposits	5,506.4	4,946.9	7,300.5	13,335.9	23,751.5
Other	791.4	895.7	1,992.3	1,372.6	1,900.3
Total	178,744.1	202,783.9	247,184.3	300,941.8	322,356.0

T5413/10-2-81

Source: Executive Budget, FY 1981-82 and FY 1982-83, Nevada State Budget Office.



Gaming and associated tourist related industries are the dominant source of income to the state of Nevada.

Table 3.2.3.3-2. General fund appropriations and gaming authorizations, state of Nevada (thousands of dollars).

	1976-77	1977-78	1978-79	1979-80	1980-81
General Government					
Executive	7,381.1	8,706.0	9,761.1	9,783.3	9,988.2
Legislative and Judicial	3,849.2	4,530.1	7,990.6	6,205.4	6,769.5
Sub-Total	11,230.3	13,236.1	17,751.7	15,988.7	16,757.8
Education					
University System	43,925.2	46,929.2	51,992.2	58,164.0	63,180.6
Department of Education	66,543.2	75,449.7	84,218.9	133,990.6	143,173.0
Other	1,199.1	1,372.8	2,918.8	1,751.2	1,796.8
Sub-Total	111,667.5	123,751.7	137,757.1	193,905.8	208,150.5
Human Resources					
Health Division	4,097.4	4,759.0	5,415.4	5,720.4	6,348.2
Mental Hygiene and Mental Retardation Administration	10,473.6	13,175.7	13,558.3	14,458.5	15,740.9
Welfare	15,868.7	22,117.1	23,790.3	31,685.8	36,675.0
Rehabilitation	1,675.7	2,288.4	2,609.6	2,094.5	2,153.2
Youth Services	5,774.2	6,488.3	6,778.5	6,666.5	6,865.5
Other	246.5	289.7	296.6	288.3	293.9
Sub-Total	38,136.1	49,118.2	52,449.2	60,914.4	68,076.7
Public Safety	9,250.0	12,985.4	15,455.7	19,508.5	20,969.8
Regulatory	5,042.3	6,710.5	7,210.9	9,731.7	10,306.9
Conservation and Agriculture	4,460.5	6,608.9	8,197.9	8,541.9	7,965.5
Miscellaneous	44,799.2	8,550.2	27,410.1	46,280.7	15,278.4
Total General Fund Appropriations*	224,589.9	220,961.0	266,232.6	354,871.7	347,505.5

T5414/8-21-81

*Less capital improvements.

Source: Summary of General Fund Revenue and Expenditures, Selected Years, Nevada State Office of the Budget.

Table 3.2.3.3-3. Nevada total net general fund operating expenditures, selected years (thousands of dollars).

Expenditure Type	FY 75-76	FY 77-78	FY 79-80
General Government	11,509	14,050	16,971
Education	101,026	110,386	184,645
Human Services	39,877	43,875	58,731
Public Safety	7,952	12,827	19,095
Regulatory	4,732	6,228	9,074
Conservation and Agriculture	4,722	6,131	7,737
Miscellaneous	3,559	3,158	4,929
Total	173,377	196,655	301,182

T5292/9-23-81/F

Source: Unpublished data compiled from Nevada M-X Project Budget Office, 1981.

Table 3.2.3.3-4. Summary of Utah State Revenues, FY 1975 - FY 1980 (thousands of dollars).

Revenue Source	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Taxes						
General Sales Taxes	173,737	194,922	225,794	258,463	293,567	321,089
Motor Fuel Taxes	48,417	51,858	54,671	58,778	74,112	75,126
Miscellaneous Exise Taxes	19,835	20,998	23,613	26,016	22,559	26,036
License Taxes	22,705	23,437	27,298	28,082	29,869	28,869
Individual Income Taxes	104,919	140,562	158,271	188,053	226,783	265,328
Corporate Income Taxes	18,003	24,502	24,867	29,449	32,874	40,377
Severance Tax	6,237	11,723	8,931	8,926	8,993	10,584
Liquor Monopoly Profits	9,794	10,456	10,580	11,527	12,992	15,054
Unemployment Taxes	21,404	22,978	37,584	46,033	51,770	53,468
Other Taxes	4,674	3,688	5,788	4,235	1,571	4,130
Total Taxes	429,725	505,123	577,398	659,562	760,702	846,765
Other Revenue Sources						
Federal Aid	220,441	304,135	292,906	334,740	355,143	437,076
Interest Earnings	36,226	36,674	40,176	49,550	32,519	40,900
Fees and Sales	24,871	23,605	20,254	20,568	58,418	65,283
Miscellaneous Revenue	22,567	26,422	30,111	35,538	32,345	67,721
Total Other Revenue	83,664	86,701	90,541	105,746	123,282	173,904
Total State Revenues	733,831	895,958	960,844	1,100,048	1,239,127	1,457,745
Tax Rebates	--	--	--	--	--	47,707
Net State Revenue	733,831	895,958	960,844	1,100,048	1,239,127	1,410,038

T5415/8-21-81

Source: Statistical Review of Government in Utah, 1977, 1979, 1980, 1981, Utah Foundation.

Table 3.2.3.3-5. Summary of Utah state expenditures, 1974-75 through 1978-79 (thousands of dollars).

Expenditures by Function	1974-75	1975-76	1976-77	1977-78	1978-79
Education					
Higher Education	117,098	144,377	157,909	152,546	167,216
Public Education	240,899	258,670	283,638	322,037	357,300
Total Education	357,998	403,046	441,546	474,583	524,515
Highways	107,512	135,774	133,831	128,609	160,379
Public Welfare	84,684	103,548	122,853	148,591	173,170
Employment Security	59,588	83,543	72,410	64,899	69,322
Health and Hospitals	28,751	33,984	41,395	50,407	59,676
Natural Resources	28,442	31,920	39,530	44,577	37,792
Police and Correction	24,465	28,191	32,719	37,475	41,107
Administration and Control	23,389	27,522	31,598	39,489	47,185
Capital Projects	--	--	--	34,413	38,189
Other Expenditures	47,700	61,329	66,144	85,766	88,277
Total State Expenditures	762,528	908,857	982,026	1,108,808	1,239,613

T5416/9-23-81/F

Source: Statistical Review of Government in Utah, 1977, 1979, 1980, 1981, Utah Foundation.

1978-79. Much of this increase was due to increased expenditures on education (11.6 percent average annual rate of growth) and public welfare (26.1 percent average annual rate of growth). Together education and public welfare comprised over 56 percent of total expenditures in 1978-79.

Population and Housing (3.2.3.4)

Population (3.2.3.4.1)

With the exception of the Salt Lake City, Provo/Orem, and Las Vegas metropolitan areas, the Nevada/Utah region of influence (ROI) consists of sparsely settled rural counties with small, widely separated towns which function as agricultural, ranching, mining, or commercial centers. Although the majority of these communities has fewer than 1,000 residents, several have populations of more than 2,500, including Cedar City, St. George, and Nephi in Utah, and Ely and Tonopah in Nevada.

The population of the 12-county ROI was 1.4 million in 1980, an increase of 453,000 persons (48.7 percent) since 1970, as shown in Table 3.2.3.4-1. The region constituted one of the fastest growing large areas in the nation during the past decade, with an annual growth rate of four percent. More than 90 percent of the ROI's population, 1.3 million persons, resided in the three metropolitan areas, while the nine rural counties contained 84,437 residents. Similarly, about 95 percent of the region's growth between 1970 and 1980 occurred in the Salt Lake City, Provo/Orem, and Las Vegas areas, although the population of the nine rural counties expanded by 23,975 persons during the decade. The rate of population expansion was considerably higher in Nevada than in Utah; both states, however, were among the five fastest growing in the nation during the 1970s. As shown in Table 3.2.3.4-2, the 12-county bi-state region's population would reach about 1.9 million by 1990, representing an annual compound growth rate of 3.0 percent during the next decade.

Nevada

The population of the five-county Nevada portion of the ROI grew at an annual rate of 5.2 percent during the 1970s, reaching about 484,000 residents in 1980. More than 95 percent of the population in 1980, and 98 percent of the growth during the past decade, was in metropolitan Las Vegas (Clark County). Population changes since 1970 ranged from growth of 69 percent in Clark to a decline of 19.5 percent in White Pine County. Although population losses, associated with Kennecott's copper mine closing, occurred during the mid 1970s, White Pine has experienced moderate growth more recently. In addition to the cities in the Las Vegas Valley, other communities in the deployment area with more than 1,000 residents are Ely in White Pine County and Tonopah in Nye, with 1980 populations of 4,882 and about 2,500, respectively. Except for Clark County, which has an average density of 59 persons per sq mi, the Nevada counties within the ROI are sparsely settled, with less than one person per sq mi in 1980.

As shown in Table 3.2.3.4-3, the populations of the Nevada counties were predominantly white in 1980. The largest concentrations of racial and ethnic minority groups were found in Clark County where 6.4 percent of the population was black, 6.6 percent was Native American, and 7.6 percent was of Spanish origin. In parallel with national trends, the age distribution of the population has become older

Table 3.2.3.4-1. Population and population change 1970 to 1980, by county, in the Nevada/Utah impact region.

State/County	Population			Population Change 1970-1980		
	1970 Census Count	1976 Estimated	1980 Census Count	Number	Percent Change	Annual Rate[1]
Nevada	488,738	610,000	799,184	310,446	63.5	5.0
Clark	273,288	343,400	461,816	188,528	69.0	5.4
Eureka	948	1,200	1,198	250	26.4	2.4
Lincoln	2,557	2,80	3,732	1,175	46.0	3.9
Nye	5,599	5,900	9,048	3,449	61.6	4.9
White Pine	10,150	10,000	8,167	-1,983	-19.5	-2.2
5-County Total	292,542	363,300	483,961	191,419	65.4	5.2
Utah	1,059,273	1,228,000	1,461,037	401,764	37.9	3.3
Beaver	3,800	4,100	4,378	578	15.2	1.4
Iron	12,177	14,700	17,349	5,172	42.5	3.6
Juab	4,574	4,900	5,530	956	20.9	1.9
Millard	6,988	8,200	8,970	1,982	28.4	2.5
Salt Lake	458,607	524,700	619,066	160,459	35.0	3.0
Utah	137,776	170,300	218,106	80,330	58.3	4.7
Washington	13,669	18,700	26,065	12,396	90.7	6.7
7-County Total	637,591	745,600	899,464	261,873	41.1	3.5
12-County ROI	930,133	1,108,900	1,383,425	453,292	48.7	4.0

T5121/8-20-81

[1] Annual compound rate of change.

Sources: U.S. Bureau of the Census, Nevada Final Population and Housing Unit Counts, (PHC80-V-30); Utah Final Population and Housing Unit Counts, (PHC80-V-46), March 1981.

Table 3.2.3.4-2. Projected population by county, Nevada/Utah impact region, assuming trend growth and growth associated with other projects in some counties, 1980-1994.

State/County	1980 Census Count	Projected Population 1980 Trend Growth	1980 High Growth	1985 Trend Growth	1985 High Growth	1990 Trend Growth	1990 High Growth	1994 Trend Growth	1994 High Growth
Nevada									
Clark	461,816	461,816	461,816	550,000	550,973	664,000	664,735	744,410	745,296
Eureka	1,198	1,198	1,198	1,302	1,302	1,421	1,420	1,510	1,510
Lincoln	3,732	3,732	3,732	4,286	4,292	4,969	4,965	5,590	5,595
Nye	9,048	9048	9,048	10,786	10,791	12,471	12,473	13,790	13,795
White Pine	8,167	8,167	8,167	8,237	12,582	8,291	12,647	8,330	13,142
5-County Total	483,961	483,961	483,961	574,611	579,940	691,152	696,240	773,630	779,338
Utah									
Beaver	4,378	4,455[1]	4,776	5,051	10,993	5,297	9,965	5,516	10,566
Iron	17,349	17,449	17,460	20,348	20,500	22,895	23,006	24,556	24,677
Juab	5,530	5,544	5,613	6,888	9,274	7,650	8,364	8,077	8,849
Millard	8,970	8,915	10,459	10,940	18,746	12,179	14,920	12,528	15,504
Salt Lake/Utah	837,172	822,238	822,793	980,701	987,123	1,079,131	1,083,344	1,144,685	1,149,699
Washington	26,065	22,150	22,150	27,200	27,200	31,150	31,150	33,802	33,802
7-County Total	899,464	880,751	882,951	1,051,128	1,073,836	1,158,302	1,170,749	1,229,164	1,243,097
Deployment Region	1,383,425	1,364,712	1,366,912	1,625,739	1,653,776	1,849,454	1,866,989	2,002,794	2,022,435

T5122/9-18-81

[1] 1980 projected population may not equal 1980 census count since some state demographic projection models have not yet incorporated 1980 census data.

Sources: U.S. Bureau of the Census, Nevada Final Population and Housing Unit Counts, (PHC80-V-30); Utah Final Population and Housing Unit Counts, (PHC80-V-60), March 1981.

Bureau of Economic and Business Research, University of Utah; Governor's Office of Planning Coordination, State of Nevada, 1980.

Table 3.2.3.4-3. Selected population characteristics, by county, Nevada/Utah deployment area, 1980.

State/County	Density Persons/Sq Mi	Racial/Ethnic Groups as Percent of Total Population			Households	
		Black	American Indian	Spanish Origin	Number	Average Size
Nevada	7.3	6.4	1.7	6.7	304,001	2.59
Clark	58.7	10.0	6.6	7.6	173,563	2.63
Eureka	0.3	0.0	3.1	5.7	446	2.66
Lincoln	0.4	0.3	1.7	7.5	1,270	2.86
Nye	0.5	0.6	3.9	5.6	3,434	2.61
White Pine	0.9	0.1	2.8	9.4	3,003	2.68
Utah	17.8	0.6	1.3	4.1	448,603	3.20
Beaver	1.7	0.0	0.6	1.9	1,428	3.06
Iron	5.3	0.1	2.1	1.4	5,168	3.28
Juab	1.6	0.0	0.8	1.0	1,707	3.21
Millard	1.3	0.0	1.5	1.8	2,728	3.28
Salt Lake	810.3	0.7	0.7	5.0	201,742	3.03
Utah	108.3	0.1	0.9	2.3	58,515	3.59
Washington	5.6	0.0	1.0	1.1	7,801	3.28

T5266/8-26-81

Sources: U.S. Bureau of the Census, Nevada Final Population and Housing Unit Counts, (PHC80-V-30); Utah Final Population and Housing Unit Counts, (PHC80-V-46), March 1981; and Population and Households by States and Counties, (PC80-51-2), May 1981.

since 1970. The state's median age increased to 30.3 years in 1980 from 27.9 in 1970, and the proportion of school-age population (5-17) declined to 19.9 percent in 1980 from 26 percent in 1970. Average household sizes also decreased substantially during the past decade; for example, from over three persons per household in Clark County in 1970 to 2.63 in 1980.

During the next decade, the population of the five-county area is projected to expand by 207,000 persons, reaching 695,000 by 1990. As shown in Table 3.2.3.4-4, population projections indicate that the area would grow at a slightly faster pace in the second half of the next decade (3.8 percent annually) than in the first half (3.5 percent annually), although the projected growth rates in both periods are considerably below historical rates of change. About 98 percent of the region's growth during the 1980s is forecasted to occur in Clark which, along with Nye and Lincoln, would have the highest rates of growth. Substantially slower growth is projected in Eureka and White Pine, although several projects proposed to be developed concurrently with M-X in White Pine could add another 4,400 residents to that county by 1985, producing an annual growth rate in excess of nine percent.

Utah

The number of residents in the seven-county Utah portion of the ROI expanded by 262,000 during the last decade, reaching a population of 899,000 in 1980. Annual growth rates during the 1970s ranged from a high of 6.7 percent in Washington County, which almost doubled its population, to a low of 1.4 percent in Beaver. In 1980, about 93 percent of the region's population was concentrated in the urban counties of Utah and Salt Lake. The five rural counties, however, grew by 21,000 residents during the decade. As in Nevada, except for the metropolitan counties the region is sparsely settled, with densities ranging from 5.6 persons per sq mi in Washington to a low of 1.3 in Millard County. Outside the Salt Lake City and Provo/Orem urban areas, the larger communities include St. George (11,350), Washington (3,092), and Hurricane (2,361) in Washington County; Cedar City (10,972) in Iron County; Fillmore (2,083) in Millard County; and Nephi (3,285) in Juab County.

Racial and ethnic minority groups comprise very small proportions of residents in the Utah counties, especially outside the Salt Lake City area (See Table 3.2.3.4-3). Persons of Spanish origin constitute the largest minority group, with its share ranging from 5.0 percent in Salt Lake to 1.0 percent in Juab; the share of blacks ranged from 0.7 percent in Salt Lake to zero percent in Beaver, Juab, Millard, and Washington; and Native Americans ranged from 2.1 percent in Iron to 0.6 percent in Beaver County. The age distribution of Utah residents has become older since 1970, although it remains considerably younger than that of Nevada and the rest of the nation, reflecting its higher birth rate. The median age in Utah increased to 24.2 years in 1980 from 23 in 1970. The proportion of school-age population (5-17) declined from 29.6 percent in 1970 to 24.3 percent in 1980. Average household size also decreased during the decade, although the 3.2 persons per household in Utah remains the highest of any state.

By 1990, the number of residents in the seven-county region is forecasted to reach 1.8 million assuming trend growth, but could reach 1.9 million if the proposed mining, energy, and industrial projects are developed in several of the rural counties at the same time as M-X. As in Nevada, the major share of the forecasted growth (93 percent) is projected to occur in the metropolitan portion of the region, although the rural counties are projected to add 20,700 residents during the next decade with trend growth, or 29,000 residents if other large-scale projects are developed as

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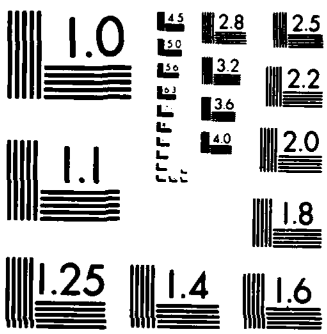

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 3.2.3.4-4. Projected annual rates of population change in the Nevada/Utah ROI, with trend growth and with growth associated with projects other than M-X.

State/County	1980-1985		1985-1990		1990-1994	
	Trend Growth	High Growth	Trend Growth	High Growth	Trend Growth	High Growth
Nevada						
Clark	3.56	3.59	3.84	3.84	2.90	2.90
Eureka	1.68	1.68	1.76	1.76	1.55	1.55
Lincoln	2.80	2.84	3.00	2.96	2.99	3.03
Nye	3.58	3.59	2.95	2.94	2.55	2.55
White Pine	0.17	9.03	0.13	0.10	0.12	0.96
5-County Total	3.49	3.68	3.76	3.72	2.86	2.86
Utah						
Beaver	2.54	18.14	0.96	-1.94	1.02	1.47
Iron	3.12	3.26	2.39	2.33	1.77	1.77
Juab	4.44	10.56	2.12	2.04	1.37	1.42
Millard	4.18	12.38	2.17	-4.46	0.71	0.96
Salt Lake/Utah	3.59	3.71	1.93	1.88	1.49	1.50
Washington	4.19	4.19	2.75	2.75	2.06	2.06
7-County Total	3.60	3.99	1.96	1.74	1.50	1.51
12-County Deployment Region	3.56	3.88	2.61	2.45	2.01	2.02

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Sources: HDR Sciences, based on data from the Bureau of Economic and Business Research, University of Utah, 1980; and the Nevada Governor's Office of Planning Coordination, 1980.

proposed. Annual growth rates are projected to vary from about 2.5 percent in Beaver County to 4.4 percent in Juab during the next five years, but could range as high as 18 percent annually in Beaver if other projects are developed.

Housing (3.2.3.4.2)

Nevada/Utah

By 1994, projected baseline housing unit requirements will total 716,000 in the 12 county, two-state Tier I siting area. Growth from a 1982 projected baseline of 518,000 units will average 2.7 percent per year. Of the 1994 total, 43 percent (308,000 units) are anticipated for Nevada, virtually all of them in Clark County, which is projected to experience an increase of 99,000 units over the period. Of the projected growth of 407,000 units for Utah, the majority will be in Salt Lake and Utah counties. Projected baseline housing unit figures at the county and deployment region levels are presented in Table 3.2.3.4.2-1. More detailed baseline information for those counties that are expected to experience long-term effects is presented here. Counties experiencing only short-term impacts are dealt with in Chapter 4 only.

Transportation (3.2.3.5)

Roads (3.2.3.5.1)

The area is served by U.S. Highways 6, 50, and 93 and State Routes 2, 7, 8A, 21, 25, 38, 46, and 51 in Nevada; and 21, 56, 130 and 257 in Utah. Although not in the study area, Interstate Routes 70, 80, and 15 provide access to the area. These highways are shown on Figure 3.2.3.5-1, along with the annual average daily traffic for 1980 in Nevada and 1978 in Utah. Within the study area these routes connect small cities and communities, none of which has a population over 10,000.

State and federal routes are primarily two-lane paved roads. Numerous lesser quality roads are graded, unsurfaced roadways, or unimproved trails created by regular usage. Traffic volumes are very light and the roadway network accommodates this traffic at a high level of service. Most of the roads were designed for a small volume of heavy vehicles. It is doubtful that they could accommodate a large increase in heavy vehicles without experiencing rapid deterioration and increased maintenance costs.

The capacity of most segments of the existing highway system to carry automobiles and other light vehicles is relatively high for two lane roads, since they are generally in good condition, with good alignment and moderate grades. However, through mountain passes, highway alignment and grade are influenced by the topography causing a corresponding reduction in capacity. Critical sections with restricted capacity are shown on Figure 3.2.3.5-2. These are listed in Table 3.1-1 of ETR-19.

Load-carrying limits in both Nevada and Utah are based on the number of axles. Load limits are 20,000 lb for a single axle and 34,000 lb for a tandem axle in Nevada, and 18,000 lb and 34,000 lb, respectively, in Utah. Length, height, and size limits are 70 ft, 14 ft, and 8 ft, respectively, in Nevada, and 65 ft, 14 ft, and 8 ft in Utah.

Table 3.2.3.4.2-1. Projected baseline housing units by county, 1982-1994 (trend and high growth).

State/County	Ave. Annual % Change 1982-1994	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Nevada														
Clark	Trend 3.5	197,774	204,792	212,058	219,582	228,010	236,765	245,852	255,294	265,091	272,780	280,685	288,826	297,198
	High 3.5	197,856	204,934	212,275	219,970	228,462	237,223	246,272	255,639	265,388	273,094	281,012	289,166	297,552
Eureka	Trend 1.7	486	495	504	514	521	529	541	549	561	568	576	588	596
	High 1.7	486	495	504	514	521	529	541	549	561	568	577	588	596
Lincoln	Trend 3.0	1,440	1,483	1,528	1,574	1,619	1,667	1,718	1,770	1,821	1,876	1,935	1,990	2,052
	High 3.0	1,440	1,484	1,528	1,576	1,621	1,669	1,720	1,771	1,823	1,877	1,936	1,992	2,054
Nye	Trend 2.9	3,931	4,067	4,203	4,339	4,466	4,598	4,731	4,872	5,017	5,145	5,274	5,411	5,548
	High 2.9	3,931	4,068	4,204	4,341	4,469	4,601	4,773	4,874	5,018	5,148	5,277	5,413	5,550
White Pine	Trend 0.1	3,215	3,219	3,223	3,227	3,228	3,232	3,236	3,244	3,248	3,252	3,256	3,260	3,264
	High 4.0	3,215	3,221	3,311	4,930	5,511	6,281	5,994	5,372	4,955	5,004	5,062	5,099	5,149
Utah														
Beaver	Trend 1.4	1,598	1,640	1,685	1,735	1,755	1,771	1,787	1,803	1,818	1,838	1,859	1,877	1,893
	High 4.1	2,2[illegible]	2,973	3,375	3,772	4,112	3,439	3,334	3,668	3,419	3,476	3,531	3,587	3,626
Iron	Trend 2.4	5,893	6,080	6,290	6,514	6,678	6,833	6,995	7,161	7,329	7,463	7,602	7,735	7,861
	High 2.5	5,906	6,103	6,323	6,563	6,733	6,882	7,040	7,201	7,365	7,499	7,639	7,773	7,900
Juab	Trend 2.5	1,961	2,049	2,147	2,253	2,304	2,352	2,403	2,452	2,502	2,540	2,557	2,611	2,642
	High 2.6	2,138	2,518	2,792	3,034	3,034	3,085	3,052	2,929	2,736	2,778	2,821	2,861	2,895
Millard	Trend 2.2	3,076	3,205	3,348	3,502	3,583	3,660	3,740	3,819	3,899	3,933	3,962	3,990	4,010
	High 2.2	3,809	4,056	5,071	6,001	5,919	6,042	5,873	5,167	4,776	4,823	4,877	4,923	4,963
Salt Lake/Utah	Trend 2.3	291,095	301,702	313,319	325,866	332,892	339,210	345,894	352,298	358,572	364,437	370,187	375,520	380,354
	High 2.3	291,567	302,533	314,632	328,000	335,255	341,605	348,082	354,026	359,972	365,909	371,726	377,109	382,020
Washington	Trend 2.9	7,698	8,021	8,357	8,707	8,947	9,193	9,445	9,705	9,972	10,178	10,388	10,602	10,821
	High 2.9	7,698	8,021	8,357	8,707	8,947	9,193	9,445	9,705	9,972	10,178	10,388	10,602	10,821
Nevada/Utah Deployment Region	Trend 2.7	518,167	536,753	556,662	577,811	594,002	609,810	626,341	642,966	659,829	674,010	688,301	702,410	716,239
	High 2.8	520,292	540,406	562,373	587,407	604,625	620,548	636,086	650,601	665,985	680,[illegible]55	694,844	709,113	723,124

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Sources: HDR Sciences, based on data from the Bureau of Economic and Business Research, University of Utah, 1980; Nevada Governor's Office of Planning Coordination, 1980.

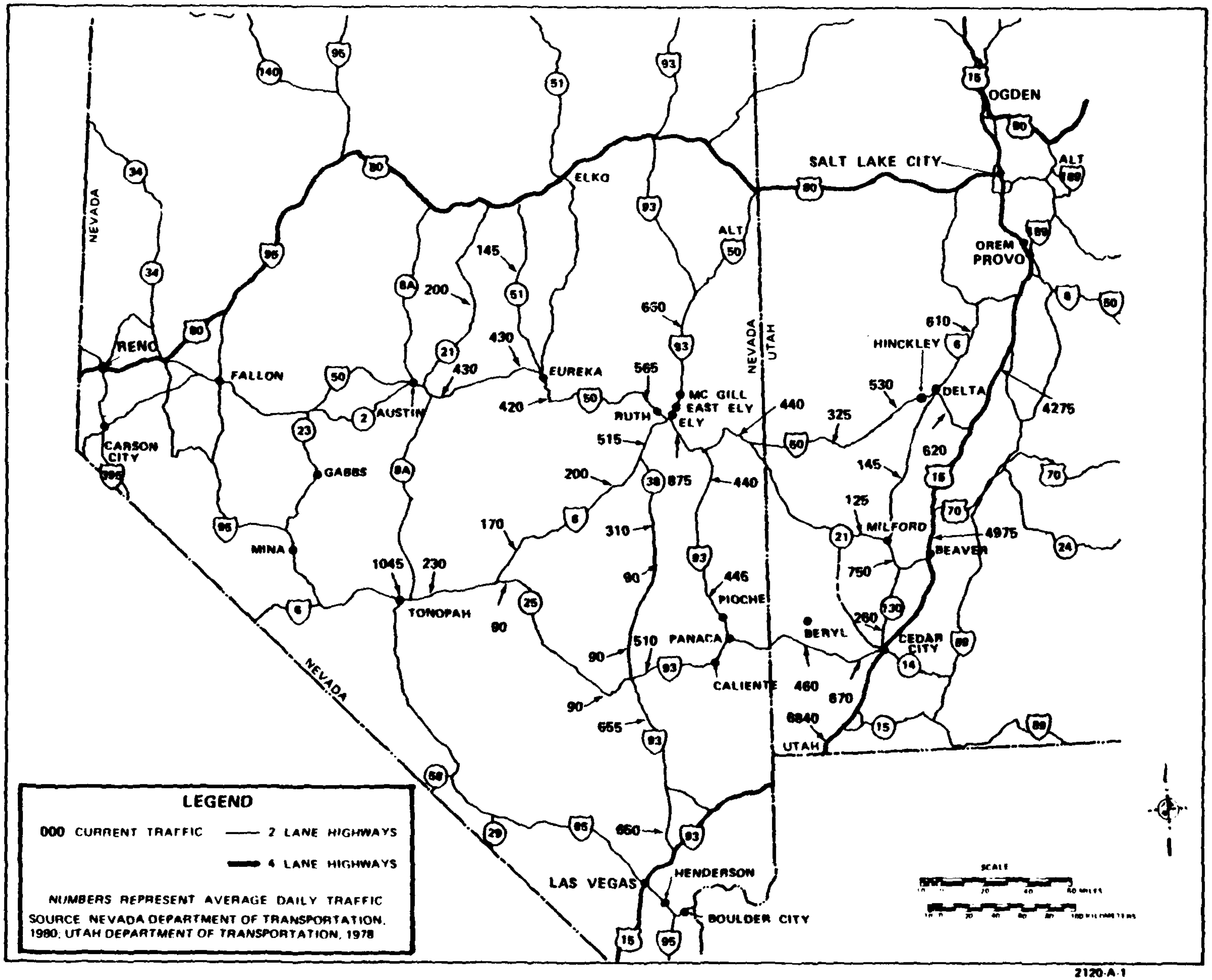

Figure 3.2.3.5-1. Existing highways and communities in the Nevada/Utah study area.

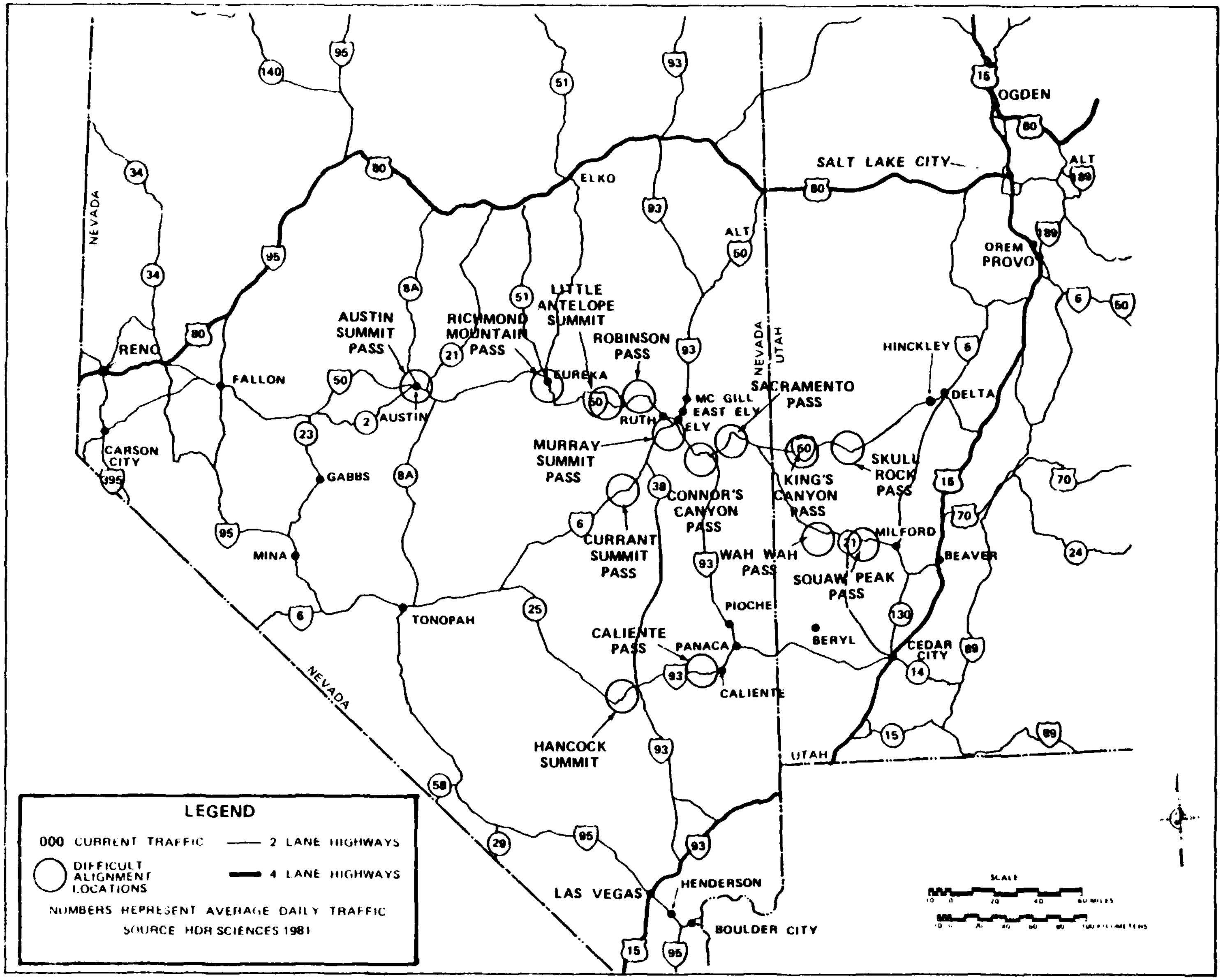

Figure 3.2.3.5-2. Difficult alignment locations, Nevada/Utah highways.

Railroads (3.2.3.5.2)

This area is served by the Nevada Northern and Union Pacific Railroads. The Nevada Northern Railroad has its southern terminus in Ruth, northwest of Ely. It runs north and south, providing rail service to Ely, McGill, Warm Springs, and Currie and intersects with the Western Pacific Railroad at Shafter, Nevada. Western Pacific runs east and west across Nevada and Utah. A Union Pacific Railroad line connects Las Vegas with Salt Lake City and provides services to Caliente, Beryl, Lund, Milford, and Delta, among other communities.

Air Traffic (3.2.3.5.3)

Major airline service is provided through the airports at Las Vegas and Reno, Nevada, and Salt Lake City, Utah. There are a number of small public and private airstrips and a limited amount of commercial traffic in Ely, Nevada, and Delta and Cedar City, Utah.

Energy (3.2.3.6)

Electric Power Supply

The Nevada/Utah study area is serviced by Regions 25, 27, and 28 of the Western Systems Coordinating Council (WSCC). Projected peak demands without M-X and actual reserve margins are presented for winter or summer conditions in Table 3.2.3.6-1. Capacity will be increased if such facilities as the Intermountain Power Project, the Harry Allen Power Plant, and the White Pine Power Project are constructed as planned. Refer to ETR-24 for detailed information on energy resources affected by M-X.

The existing and proposed transmission lines are shown in Figure 3.2.3.6-1 for the Nevada/Utah region. As can be seen, in the vicinity of the proposed M-X deployment area there are not many transmission lines.

Fuel Supply

There are few pipelines for crude oil, coal slurry, product oil, or natural gas which pass through the deployment region in Nevada/Utah. The existing and proposed pipelines have been plotted from information from the energy companies and the federal agencies and is presented in Figure 3.2.3.6-2. Among the currently proposed natural gas lines is the Rocky Mountain Pipeline, proposed from southwest Wyoming through Utah and southern Nevada and connecting into existing natural gas pipelines west of Needles, California. An alternative pipeline route for this proposed natural gas pipeline would follow U.S. Highway 650 in west central Utah and central Nevada by passing Ely. Projected fuel consumptions are presented in Table 3.2.3.6-2. In general, liquid fuels are trucked to distribution centers and distributed locally.

The Nevada/Utah region has numerous geothermal resources which may be tapped for alternative energy systems. Refer to ETR-24 for a discussion of alternative energey sources.

Table 3.2.3.6-1. Electrical peak demands (MW) and reserve margins (MW and percent); regions 25,27 and 28 (Nevada/Utah).

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Actual Reserves (MW)									
Regions 27 and 28 (Summer)[1]	10,201	12,170	11,827	11,384	10,396	10,149	9,741	9,463	8,511
Region 25 (Winter)[2]	1,910	4,035	2,579	2,335	6,377	9,157	8,983	8,177	8,558
Peak Demand									
Regions 27 and 28 (Summer)[3]	38,166	38,749	39,872	41,020	42,067	43,264	44,639	46,114	47,407
Region 25 (Winter)[4]	35,694	37,293	38,858	40,254	41,634	43,063	44,602	46,185	46,221
Actual Reserves (Percent)[5]									
Regions 27 and 28	26.7	31.4	29.7	27.8	26.0	23.5	21.8	18.4	18.0
Region 25	5.4	10.8	6.6	5.8	15.3	21.3	20.1	17.7	18.5

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[1] Reserves lowest in summer

[2] Reserves lowest in winter

[3] Demand highest in summer

[4] Demand highest in winter

[5] $\frac{\text{Actual Reserves}}{\text{Peak Demand}} \times 100$

Source: "Coordinated Bulk Power Supply Program, 1980-1990"-(DOE/ERA-411) Western Systems Coordinating Council (April 1, 1981).

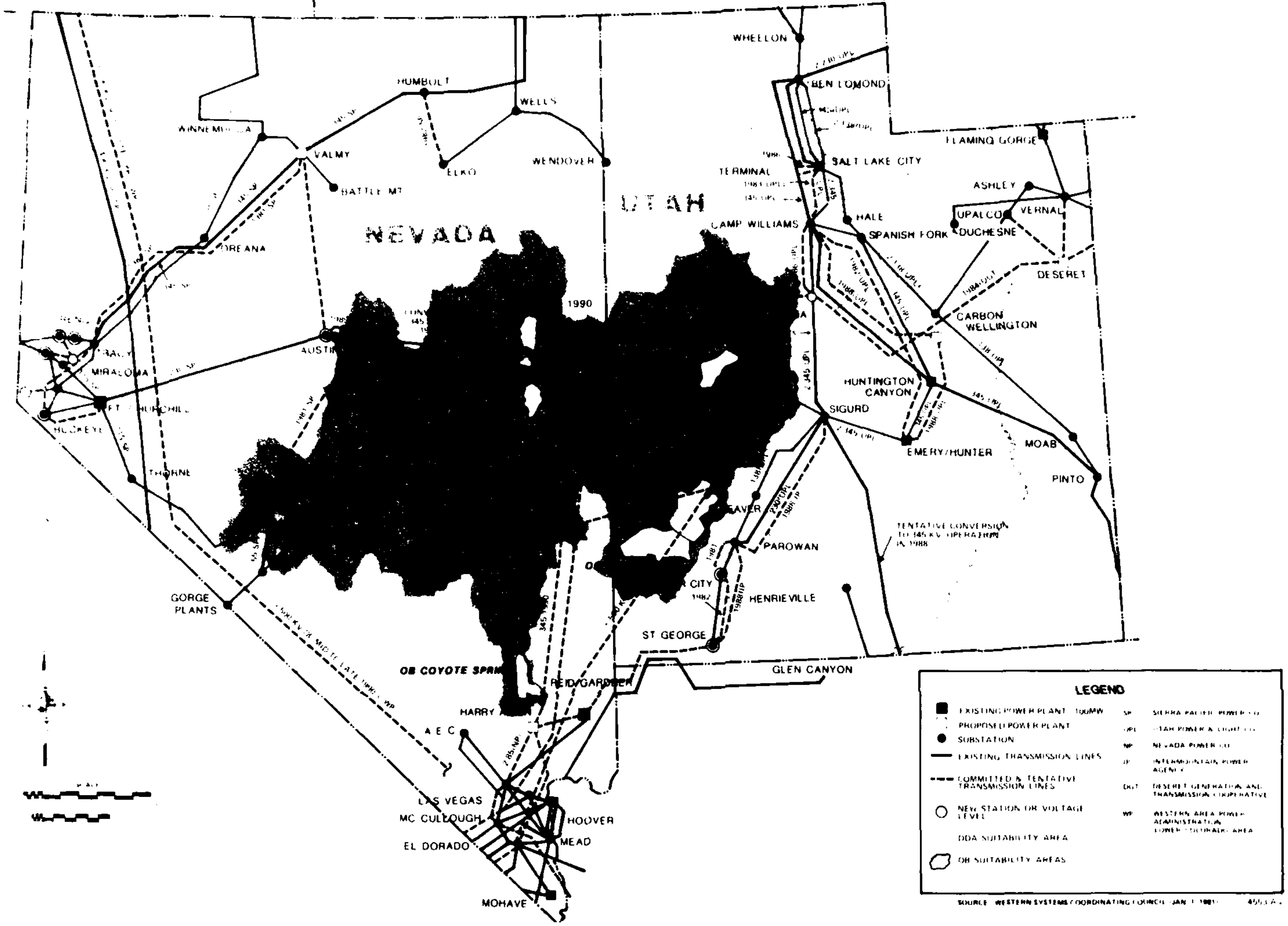

Figure 3.2.3.6-1. Existing and proposed high voltage transmission lines in Nevada/Utah.

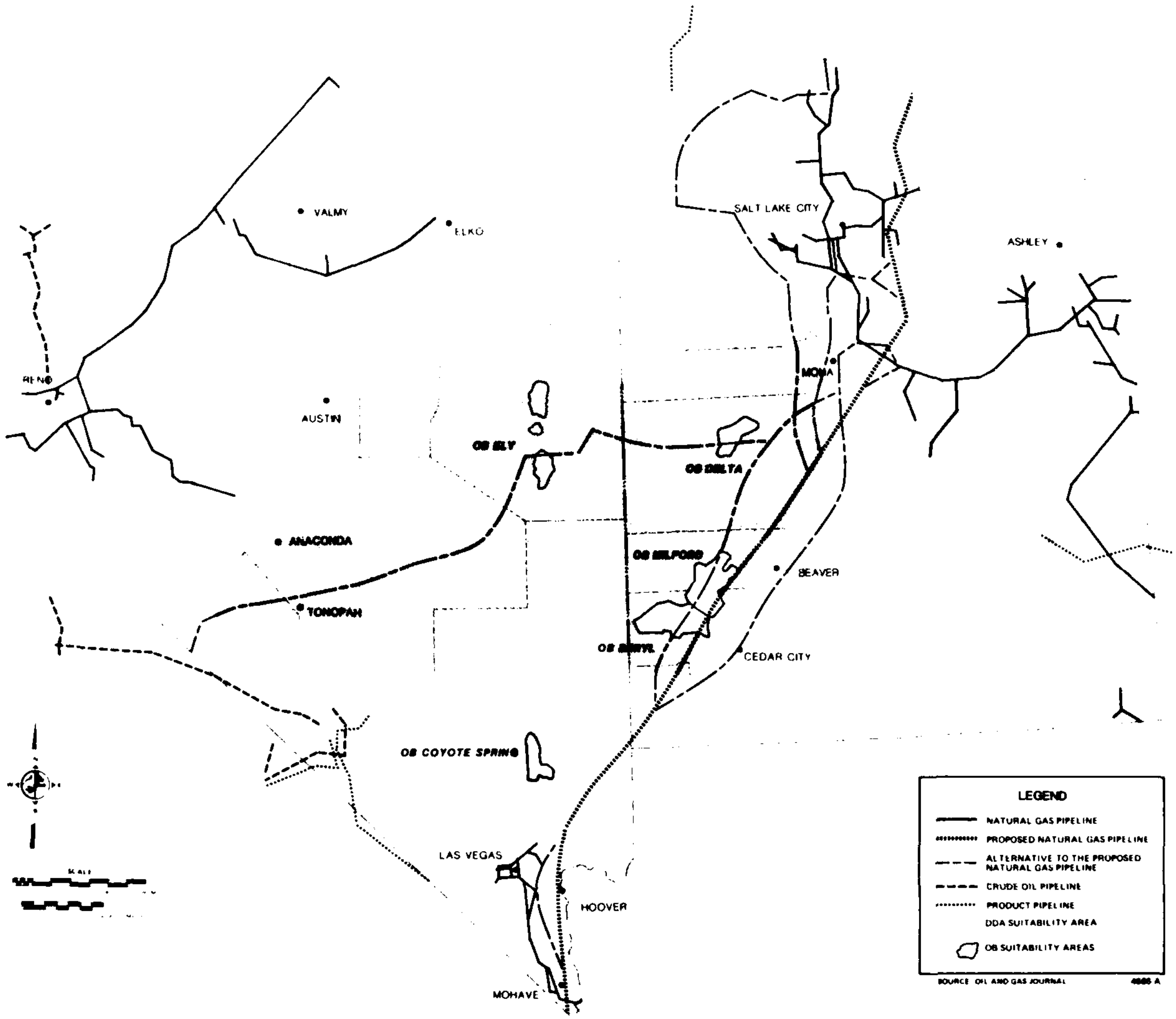

Figure 3.2.3.6-2. Existing and proposed pipelines in Nevada/Utah.

Table 3.2.3.6-2. Fuel consumption projections.

Fuel	Nevada				Utah			
	1978 (history)	1985 (mid)	1990 (mid)	1995 (mid)	1978 (history)	1985 (mid)	1990 (mid)	1995 (mid)
Total Petroleum (10^3BBLS)	29,317	23,630	23,952	22,721	40,209	32,408	32,851	31,162
Natural Gas (Dry) ($10^6 ft^3$)	64,506	59,475	57,152	55,862	118,513	109,269	105,003	102,632
Total Fuel Oil (Dist.) (10^3 BBLS)	3,822	3,230	3,344	3,455	9,023	7,624	7,895	8,157
Gasoline (10^3BBLS)	11,698	9,475	8,580	8,212	17,478	14,157	12,969	12,270
Jet Fuel (10^3BBLS)	6,652	6,273	6,652	6,652	1,898	1,790	1,898	1,898
Coal (Short tons)	4,130	6,257	8,747	11,605	5,873	8,898	12,439	16,503

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1 Barrell = 42 Gallons

Source: ETR-24, Tables 1.2-1, 1.2-4

Land Ownership (3.2.3.7)

Federal Land, Nevada/Utah

Several federal agencies administer land in the Nevada/Utah study area counties (acreages are given by county in Table 3.2.3.7-1), with the BLM, administering the largest portion. Table 3.2.3.7-2 shows the amount and percentages of BLM administered acreage by county.

Private Land, Nevada/Utah

In most cases, existing communities are located where adequate private land exists to support additional development. In some areas such as Ely, Panaca and Pioche, however, extensive growth and development of communities would be restricted if public land were not made available to them. Table 3.2.3.7-2 and Figure 3.2.3.7-1 show the location and amount of private land in each of the Nevada/Utah study area counties.

State Trust Land, Nevada/Utah

The amount and location of state trust land in Utah and Nevada is shown in Table 3.2.3.7-2 and Figure 3.2.3.7-2. Utah, as a condition of statehood, was granted four sections of federal land from each township for the support of public schools. Utah has a system of parks and monuments the greater part of which is generally undeveloped. Nevada, on the other hand, has little state land, and most of that is developed for various purposes such as state parks and historic sites.

Native American Land, Nevada/Utah

There are over 2.5 million acres of Indian reserve lands in the states of Nevada and Utah. Over 480,000 acres are within or adjacent to the study area. Native American lands are illustrated in Figure 3.2.3.9-5, (Native American Resources).

The Utah Southern Paiutes have been granted the right to select 15,000 acres of public land within the following 5 Southern Utah counties: Beaver, Iron, Millard, Sevier, or Washington. The tribe has until 1982 to decide the location of this land selection. Also, the Duckwater Shoshone have proposed the incorporation of customary grazing lands adjacent to their reservation (between 352,000 and 800,000 acres).

In 1951 the Western Shoshone petitioned the federal government for compensation for 24 million acres of ancestral land. The Indian Claims Commission awarded $26 million to the Shoshone Nation in 1974, but the settlement has been refused by the tribe, and restoration of lands demanded. The U.S. Court of Claims denied this petition in 1979, but decisions regarding separate but related cases are pending in lower courts.

Although Native American reservations are subject to federal trust status, legally they enjoy a separate identity, similar to that of other nations. Discussion on Native American lands is found in Section 3.2.3.9 (Native American Resources).

Table 3.2.3.7-1. Federally administered and Indian reservation acreage by county in the Nevada/Utah study area, in thousands of acres.

County	Forest Service	National Parks	Water And Power Resources Service[1]	Fish/ Wildlife Service	Indian Reservation	Department of Defense	Bureau of Land Management
Nevada							
Clark	39	498	50	502	4	338	3,481
Esmeralda	46	2,000	-	-	-	-	2,121
Eureka	162	-	-	-	0.2	-	2,187
Lander	279	-	-	-	0.2	-	3,303
Lincoln	23	-	-	277	-	576	6,580
Nye	1,663	92	-	-	9	2,327	10,712
Pershing	-	-	22	-	0.2	-	2,910
White Pine	856	-	-	12	70	-	4,365
Total	3,068	592	73	790	85	3,241	35,657
Utah							
Beaver	138	-	-	1	-	-	1,159
Iron	244	9	-	-	-	-	974
Juab	118	-	0.6	15	38	-	1,408
Millard	362	-	-	60	-	-	2,992
Tooele	150	-	-	-	-	1,523	1,939
Total	1,012	9	0.6	76	38	1,523	8,472
Study Area Total	4,080	601	73	866	123	4,774	44,129

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[1]Formerly Bureau of Reclamation.

Source: Department of Interior, 1978; University of Utah, 1978.

Table 3.2.3.7-2. BLM-administered, state and private lands in the Nevada/Utah study area counties, in thousands of acres.[1]

State/County	Total Land	BLM Administered Land	Percent Of Total	Privately Owned Lands	Percent Of Total	State Land	Percent Of Total
Nevada							
Clark	5,174	3,481	67.3	489.4	9.5	46.1	.9
Esmeralda	2,285	2,121	92.8	162.6	7.1	--	--
Eureka	2,688	2,187	81.4	486.2	18.2	--	--
Lander	3,597	3,303	91.8	289.7	8.1	0.3	--
Lincoln	6,816	6,580	96.5	219.4	3.2	6.7	0.1
Nye	11,561	10,712	92.7	822.7	7.1	10.5	0.1
Pershing	3,859	2,910	75.4	917.2	23.7	--	--
White Pine	5,699	4,365	76.6	392.1	6.9	1.6	--
Utah							
Beaver	1,656	1,159	70.0	272.4	16.5	145.0	8.8
Iron	2,112	974	46.1	753.1	35.7	132.1	6.2
Juab	2,184	1,408	64.5	393.9	18.0	179.8	8.2
Millard	4,255	2,992	70.3	474.0	11.1	402.7	9.5
Tooele	4,423	1,939	43.8	83.4	1.9	256.3	5.8
Total	56,309	44,129	78.4	5,756.1	10.2	1,181.1	2.1

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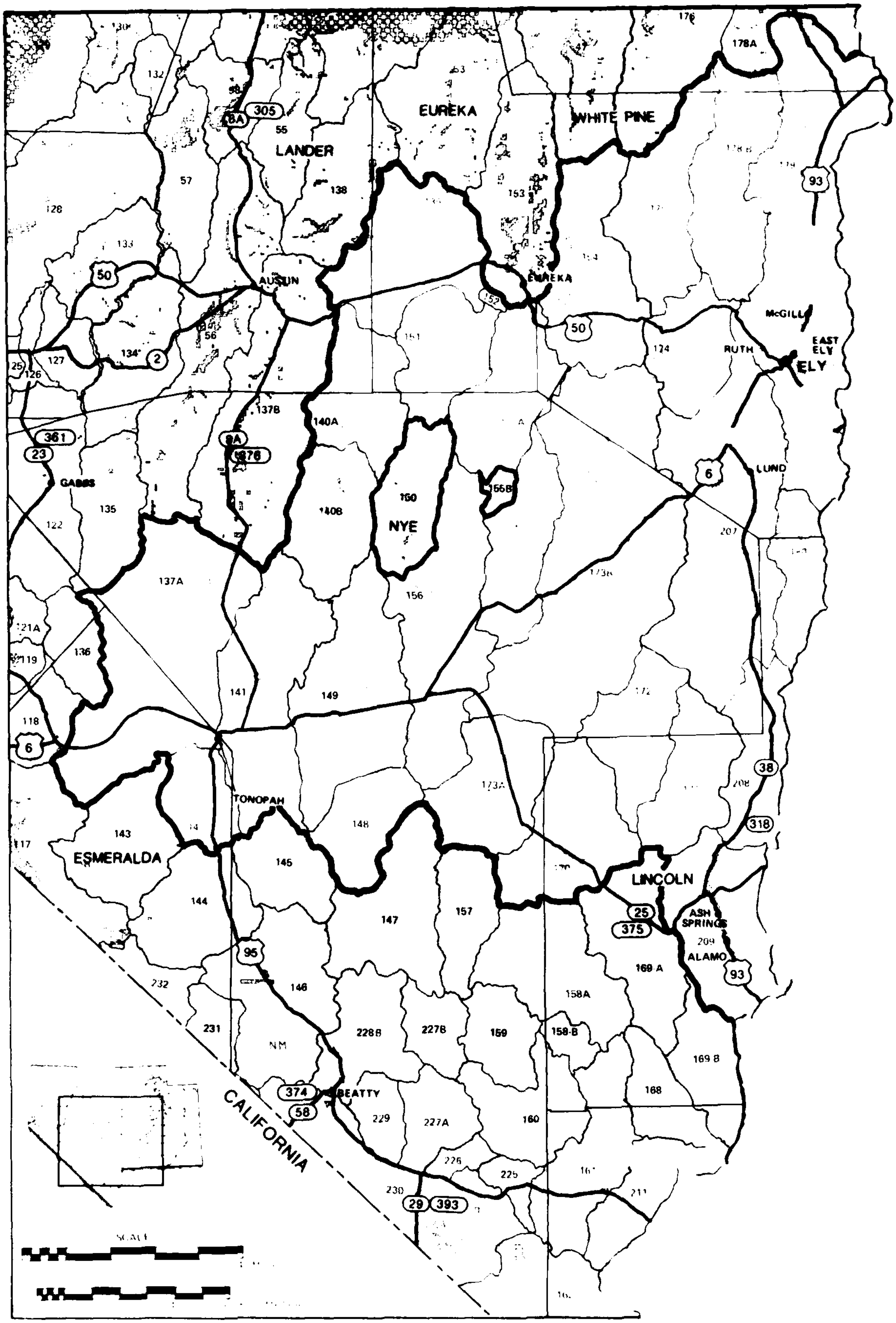
[1] Does not include lands administered by federal agencies other than the BLM.

Source: Nevada Governor's Office of Planning Coordination, January 1978, and University of Utah, 1978.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LINCOLN
ASH SPRINGS
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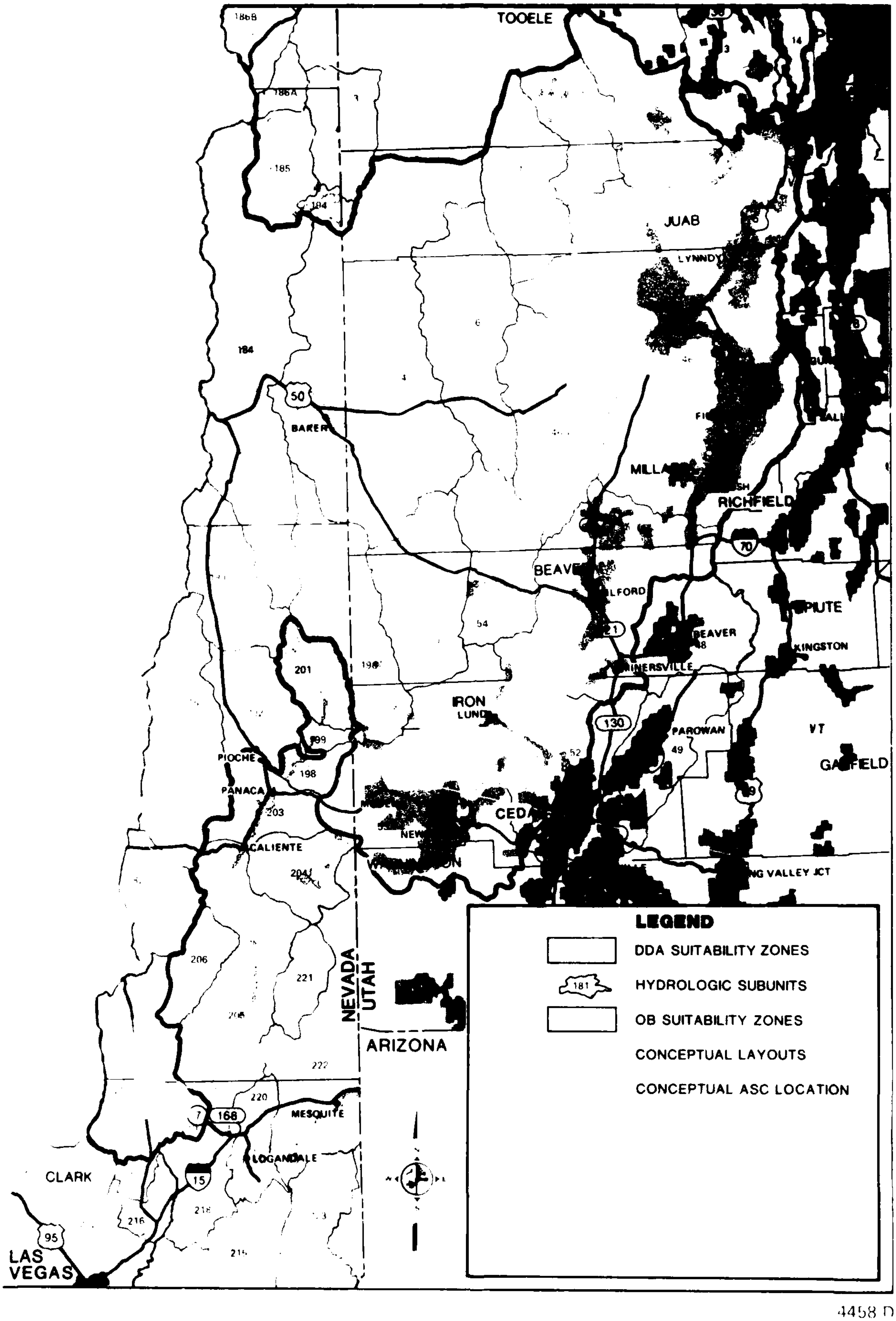
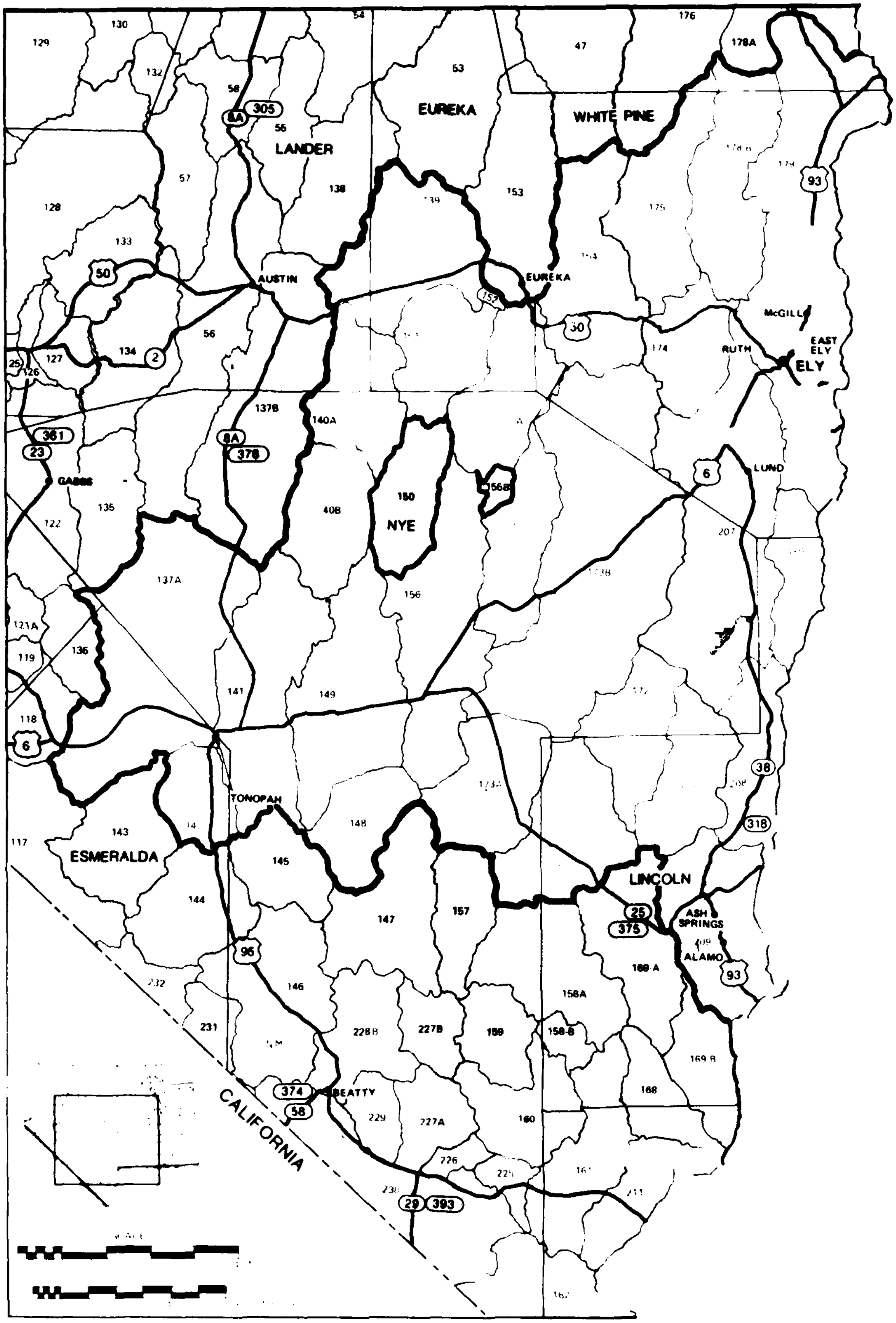


Figure 3.2.3.7-1. Private land in the Nevada/Utah study area.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AUSTIN
EUREKA
McGILL
EAST ELY
ELY
RUTH
LUND
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LINCOLN
ASH SPRINGS
ALAMO
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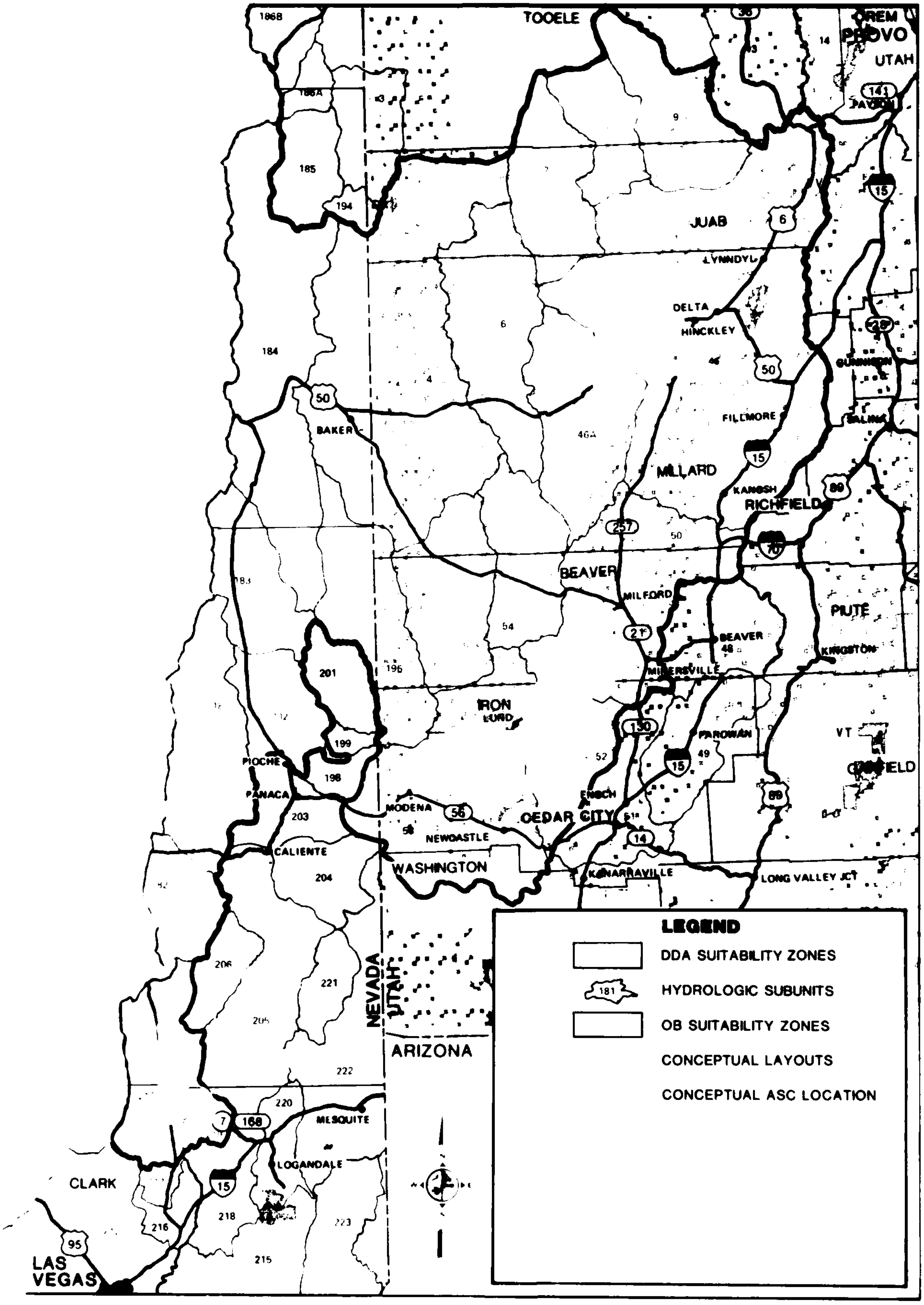

Figure 3.2.3.7-2. State land in the Nevada/Utah study area.

Land Use (3.2.3.8)

Most of the Nevada and Utah counties in the study area have few or no land use control ordinances. Those that do (e.g. Clark County) have rarely used them to protect agricultural land from urban development (Nevada Dept. of Conservation and Natural Resources, February 23, 1981; and Utah Consortium for Energy Research and Education, April 10, 1981). Nevada's agricultural development is geared toward the livestock industry; Utah's is more diversified. The numbers of farms and farming acreage are listed in Table 3.2.3.8-1. Table 3.2.3.8-2 shows trends in farming in Nevada and Utah for the past 30 years, and the market value of crops, livestock, and livestock products for 1974 is shown in Table 3.2.3.8-3.

Acreages for total cropland, harvested cropland, cropland used for pasture, and for irrigated land are shown in Table 3.2.3.8-4. These data are from the 1974 Census of Agriculture and are the only consistent data for the four states being reviewed by the EIS. At the time of this writing, data from the 1978 Census are not available in complete and consistent form. Only a few advance reports are available. It may, however, be pointed out that acreages for croplands are not likely to change significantly enough between 1974 and 1978 to affect the conclusions drawn in this report. Figure 3.2.3.8-1 illustrates the relationship of croplands to geotechnically suitable land.

The BLM is charged with the administration of the Desert Lands Entry Act. This 100-year old legislation permits individuals to acquire public lands for farming if it can be shown that there is an adequate quantity of water and adequate quality of soil. Due to earlier farming failures, the Desert Lands Entry Act has had a 15-year moratorium in Nevada. Now, however, some areas have been made available for applications for entry. Because some of the areas open for application for entry already have grazing allotments on them, there could be some conflict between the rights of ranchers and individual applicants. The BLM will resolve these differences.

Desert Land Entry applications may be filed on only about 850 sq mi in Lincoln, Nye, and White Pine counties. All but about 130 sq mi of this lies in the southern reaches of Nye County along the California border. Figure 3.2.3.8-2 shows the location of these areas. A BLM contracted study indicates that the cost of developing these areas for farming could be between $300 and $500 per acre. This means that the maximum 320 acre allotment would cost between $96,000 and $160,000 to develop. It is further stated that 600 to 1,000 acres are needed for an economic farm unit. "Even though several persons might file on adjoining parcels in a cooperative venture, there is no assurance that they will all be successful in a drawing where there is more than one applicant for one parcel of land" (U.S. Dept. of Interior, May 1979).

Prime Farmland

Although no known prime farmlands exist within the Nevada siting region, Utah has declared all irrigated land within the state to be prime farmland. A discussion and further definition of prime farmland will be found in Section 3.3.3.8 (Land Use, Texas/New Mexico).

Table 3.2.3.8-1. Farms and farmland in Nevada/Utah study area counties, 1974.

County	Number of Farms	Average Size of Farms (Acres)	Total Acreage in Farmland[1]	Farmland as Proportion of All County Land (Percentage)	County Farmland as Proportion of State Farmland (Percentage)
Nevada					
Clark	147	534	78,252	1.6	0.7
Esmeralda	29	1,521	44,120	1.9	0.4
Eureka	62	4,281	265,417	9.9	2.4
Lander	58	10,787	625,643	17.4	5.8
Lincoln	75	778	58,320	0.9	0.5
Nye	97	4,588	445,052	3.8	4.1
Pershing	97	6,670	646,954	16.8	6.0
White Pine	100	2,312	231,248	4.1	2.1
Total	665	3,602	2,395,006	--	22.8
Utah					
Beaver	183	822	150,368	9.1	1.4
Iron	337	1,365	459,917	21.8	4.3
Juab	201	780	156,760	7.2	1.4
Millard	652	823	536,409	12.3	5.0
Tooele	229	1,876	429,516	9.7	4.0
Total	1,602	1,082	1,732,970	--	16.2
Region Total	2,267	1,820	4,127,976	--	19.9

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[1]Includes all cropland, pasture, and grazing land, except that on open range under government permit.

Source: U.S. Department of Commerce, 1977; July 1980; U.S. Department of Interior, 1970 (for Esmeralda County).

Table 3.2.3.8-2. Trends in farming in Nevada/Utah, 1950-1978.

Year	Number of Farms	Acreage in Farms	Irrigated Acreage in Farms	Harvested Acreage in Farms
Nevada				
1950	3,110	7,064,000	727,000	421,000
1954	2,857	8,231,000	567,000	360,000
1959	2,354	10,943,000	543,000	338,000
1964	2,156	10,482,000	824,000	507,000
1969	2,112	10,708,000	753,000	521,000
1974	2,076	10,814,000	778,000	551,000
1978	2,877	10,475,000	899,000	598,000
Utah				
1950	24,176	10,865,000	1,138,000	1,279,000
1954	22,826	12,262,000	1,073,000	1,228,000
1959	17,811	12,688,000	1,062,000	1,062,000
1964	15,759	12,868,000	1,092,000	1,039,000
1969	13,045	11,313,000	1,025,000	1,024,000
1974	12,184	10,610,000	970,000	1,089,000
1978	14,900	10,517,000	11,850,000	1,175,000

3024/8-21-81

Source: U.S. Department of Commerce, 1977a; 1981.

Table 3.2.3.8-3. Market value of agricultural products sold, Nevada/Utah study area counties, 1974.

County	Value of Agricultural Products Sold (Thousands of Dollars)	Value of Crops and Hay (Percent of County Total)	Value of Livestock and Livestock Products (Percent of County Total)	Other Products (Percent of County Total)	Value of Agricultural Products as Proportion of State Total Percentage
Nevada					
Clark	7,734	9.8	89.3	0.9	5.8
Esmeralda	1,233	40.0	59.9	0.1	0.9
Eureka	3,476	35.8	64.2	0.0	2.6
Lander	3,821	22.3	77.7	0.0	2.9
Lincoln	2,096	17.5	82.5	0.0	1.6
Nye	3,066	38.8	60.9	0.3	2.3
Pershing	15,218	52.7	47.3	0.0	11.4
White Pine	3,399	9.9	88.5	1.6	2.5
Total	40,045	28.3	71.3	0.4	30.0
Utah					
Beaver	6,560	30.7	69.3	0.0	1.9
Iron	11,715	53.9	45.9	.2	3.4
Juab	3,133	37.0	62.3	.1	0.9
Millard	24,434	35.6	64.5	.4	7.2
Tooele	3,609	20.1	78.2	1.6	1.1
Total	49,451	38.2	61.6	0.2	14.6
Nevada/Utah Total	89,496	38.2	61.4	0.4	19.0

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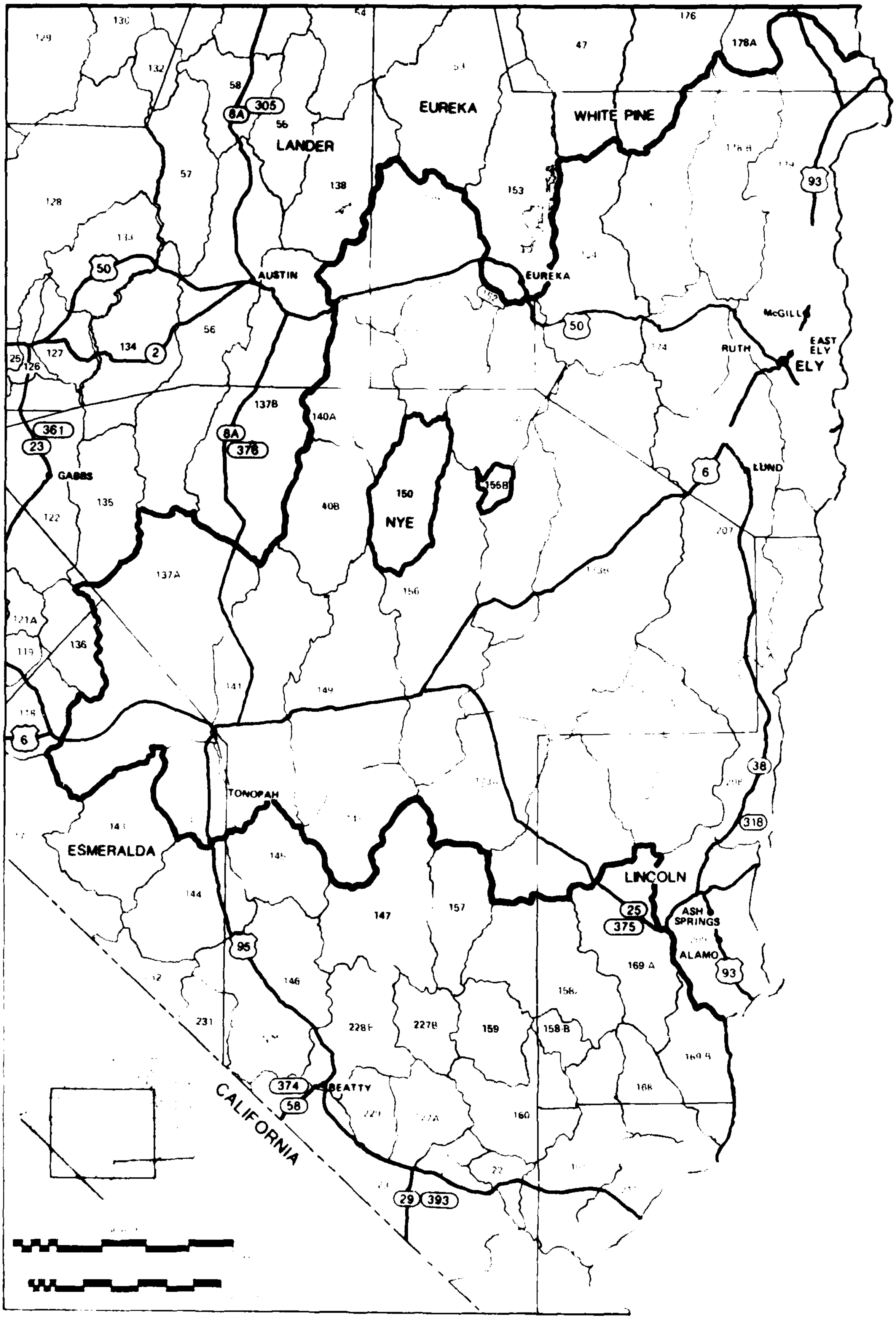
Source: Department of Commerce, 1977a.



LANDER
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WHITE PINE
NYE
ESMERALDA
LINCOLN
CALIFORNIA
AUSTIN
EUREKA
McGILL
EAST ELY
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RUTH
LUND
GABBS
TONOPAH
BEATTY
ASH SPRINGS
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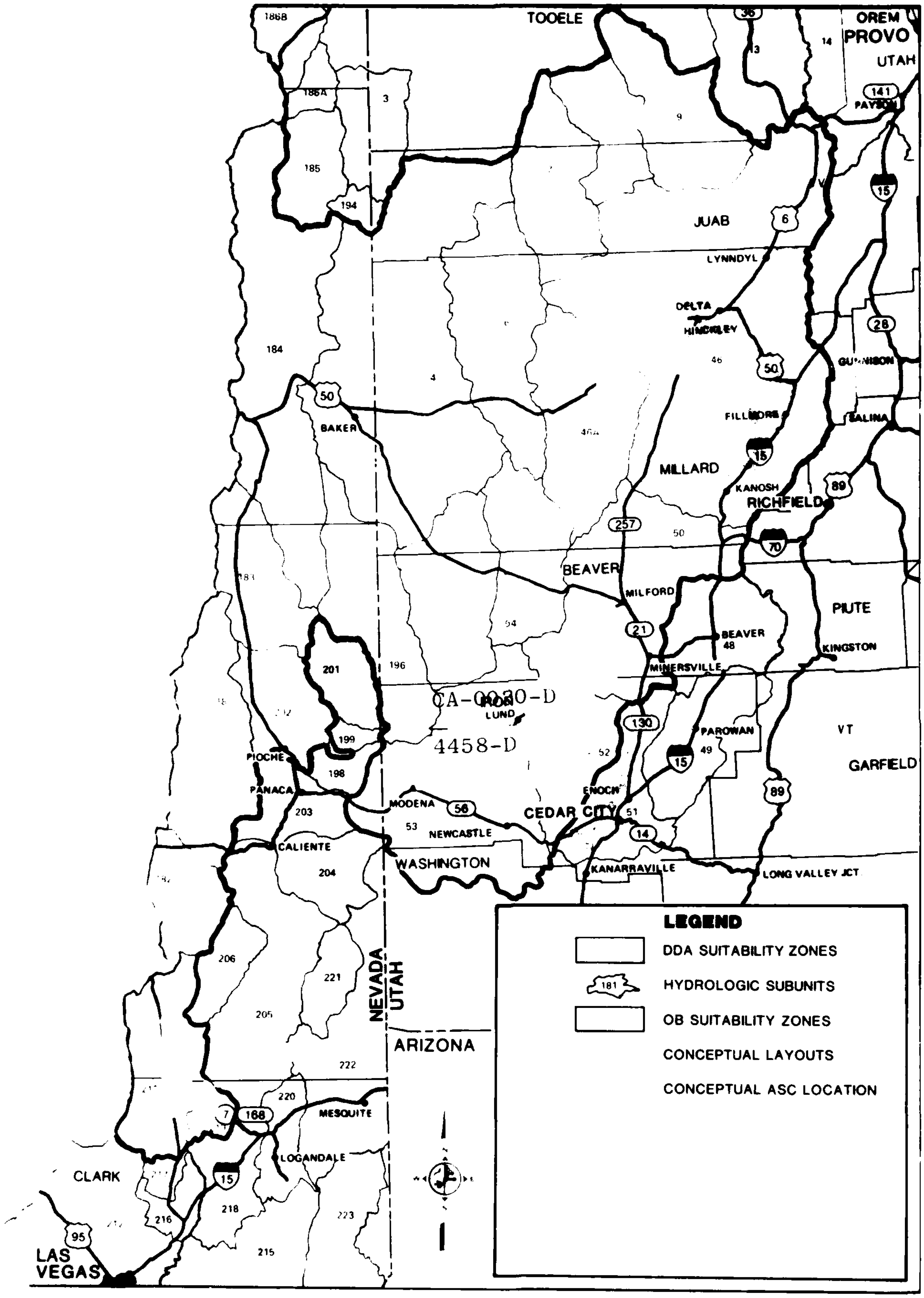

Figure 3.2.3.8-1. Irrigated cropland in the Nevada/Utah study area.

Table 3.2.3.8-4. Cropland acreage, Nevada/Utah study area counties, 1974.

County	Total Cropland	Harvested Cropland	Cropland Used Only for Pasture	Land Irrigated	Cropland as Proportion of State Cropland
Clark	12,000	8,000	2,000	11,000	1.6
Esmeralda	6,000	4,000	2,000	8,000	0.8
Eureka	34,000	24,000	6,000	31,000	4.5
Lander	38,000	28,000	4,000	32,000	5.0
Lincoln	30,000	13,000	16,000	19,000	4.0
Nye	28,000	16,000	7,000	28,000	3.7
Pershing	38,000	35,000	3,000	36,000	5.0
White Pine	28,000	15,000	7,000	24,000	3.7
Nevada Total	214,000	143,000	47,000	189,000	28.4
Beaver	27,000	21,000	4,000	23,000	1.5
Iron	66,000	43,000	16,000	46,000	3.6
Juab	60,000	26,000	16,000	14,000	3.3
Millard	157,000	98,000	25,000	93,000	8.5
Tooele	39,000	18,000	14,000	15,000	2.1
Utah Total	349,000	206,000	75,000	191,000	19.0
Nevada/Utah Total	563,000	349,000	246,000	380,000	21.7

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Source: U. S. Department of Commerce, 1977a.

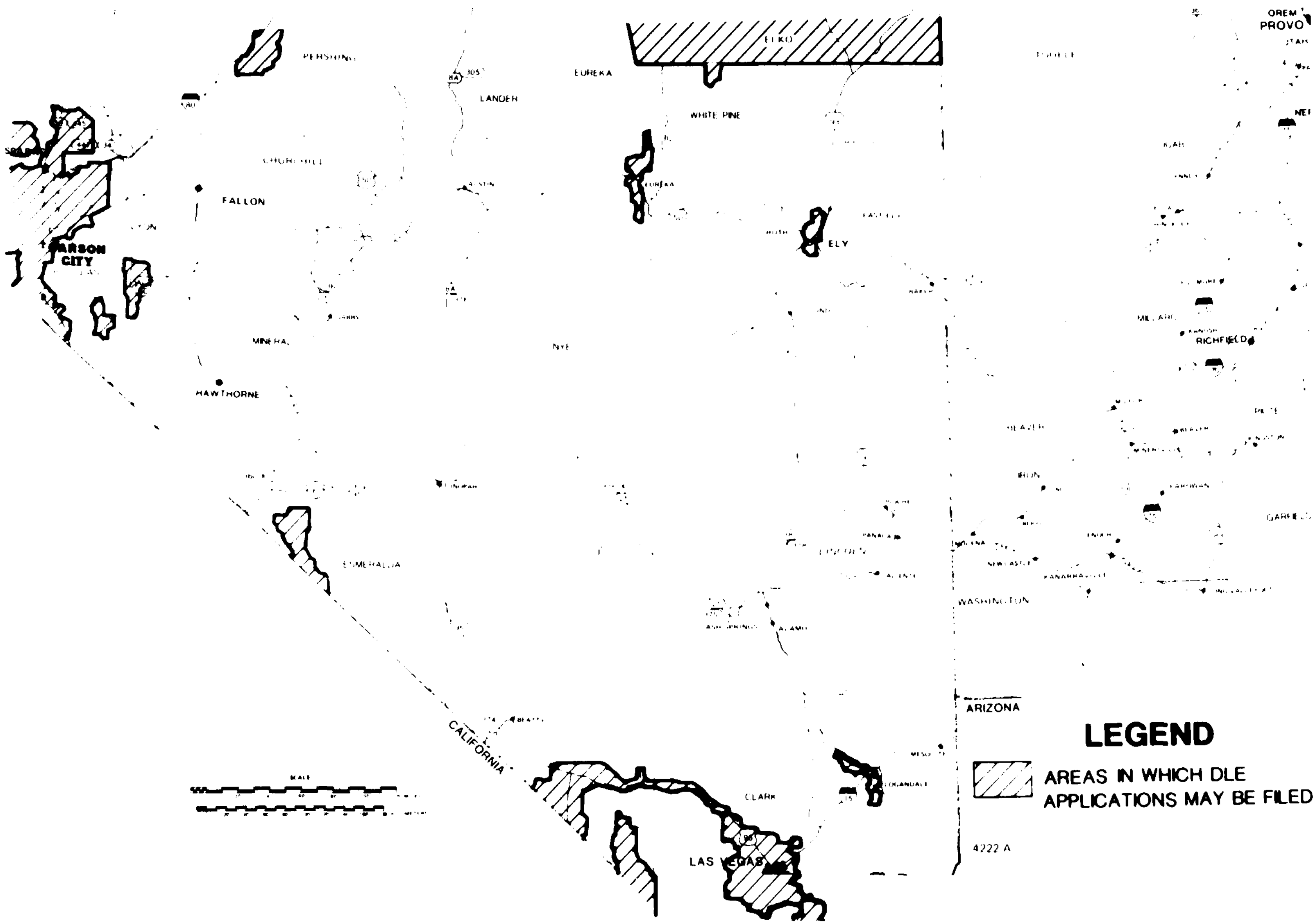

Figure 3.2.3.8-2. Desert Land Entry in the Nevada/Utah study area. (Source: U.S. Department of Interior, May 1979.)

Ranch and Farm Houses

Because almost all of the Nevada/Utah deployment area is located on public land, very few ranch and farm houses are located therein. It is estimated, however, that about ten such structures lie on private land in the geotechnically suitable areas.

Grazing

There are about 29 million acres of BLM-administered land in the Nevada/Utah study area. The BLM regulates grazing on these extensive lands through the use of permits, which are allocated on the basis of AUMs. There were 2,553,719 AUMs on 1,107 allotments on BLM land in the Nevada/Utah study area (Table 3.2.3.8-5).

Sheep and cattle, are the two most common types of livestock operations in the Nevada/Utah area. Range use between areas and seasons and between private and federal range is tightly integrated. Field studies have indicated that there are nearly 700 livestock operators using grazeable federal range in the Nevada/Utah study area. Approximately 15 percent of the Caliente Resource Area and 8 percent of the Tonopah Resource Area are unusable for grazing because of lack of water. In certain areas where water is available, its distribution is inadequate for optimum vegetation utilization by livestock, wildlife, wild horses, and burros (U.S.D.I., BLM, 1979, 1980).

Recreation

Nevada/Utah

Most of the natural resource recreational areas and campgrounds are administered by the Bureau of Land Management, U.S. Forest Service, National Park Service, Nevada Division of State Parks, and the Utah Division of Parks and Recreation. In Nevada, 92.1 percent (2,415,873 acres) of recreational areas are federal lands and 6.4 percent (168,103 acres) are state lands. In Utah, federal lands are 105,977 acres (62.0 percent) and the state provides 106,000 acres (61.2 percent). Tables 3.2.3.8-6 and 3.2.3.8-7 show the proportions of recreational land in Nevada and Utah administered by various agencies.

Campgrounds and Major Recreational Areas

There are recreational facilities and campgrounds throughout the Nevada study area concentrated mainly in Clark, Lincoln, and White Pine counties. Although Elko County has more than ten major recreational areas (Nevada SCORP) most are considered too distant from potential M-X deployment areas to receive a significant increase in recreational use from M-X.

Most recreational facilities and campgrounds in Utah are located just east of the project area. Included are numerous U.S. Forest Service developments, state parks, and other developed areas of interest. Tooele, Juab, Millard, Beaver, and Iron counties all contain portions of National Forest Service lands on which numerous campgrounds and picnic areas are situated (Figures 3.2.3.8-3 and 3.2.3.8-4).

Table 3.2.3.8-5. Distribution of allotments and grazing capacity (AUMs) in BLM resource areas affected by M-X deployment (1980).

Nevada			Utah		
BLM District and Resource Area	Number of Allotments	Grazing Capacity (AUMs)	BLM Distict and Resource Area	Number of Allotments	Grazing Capacity (AUMS)
Elko District			Salt Lake District		
Elko	137	396,053	Pony Express	83	119,075
Wells	101	375,199	Cedar City District		
Ely District			Beaver River	208	168,664
Egan	76	211,296	Dixie	81	21,176
Schell	67	278,330	Richfield District		
Las Vegas District			House Range	96	146,585
Stateline-			Warm Springs	57	157,597
Esmeralda	16	38,352	Sevier River	88	46,937
Caliente-	97	113,464			
Virgin Valley					
Battle Mountain District					
Shoshone-					
Eureka	64	317,027			
Tonopah	30	163,964			
Nevada Totals	494	1,893,685	Utah Totals	613	660,034

T4808/9-23-81

Table 3.2.3.8-6. Outdoor recreation facility inventory--acres of land facilities, Nevada, 1976.[1]

County	Federal[2]	Per-cent	State	Per-cent	Counties	Per-cent	Communities	Per-cent	Private	Per-cent	Schools	Per-cent	Total
Churchill	141,579	89.7	4,899	3.1	71	0.0	15	0.0	11,304	7.2	--	--	157,868
Clark[3]	1,552,000	93.1	109,765	6.6	803	0.1	2,392	0.1	1,934	0.1	205	0.1	1,664,099
Elko	159,814	90.1	--	--	245	0.1	257	0.1	15,743	8.9	--	--	176,059
Esmeralda	--	--	15	2.9	--	--	--	--	500	97.1	--	--	515
Eureka	--	--	--	--	1	0.0	31	4.4	667	95.4	--	--	699
Humboldt	6	2.7	46	20.9	17	7.7	125	56.8	26	11.8	--	--	220
Lander	66	17.1	296	76.5	--	--	1	0.3	24	6.2	--	--	387
Lincoln	7,341	50.4	5,366	36.8	7	0.0	14	0.0	1,852	12.7	--	--	14,580
Mineral	3,089	99.5	1	0.0	7	0.2	--	--	7	0.2	--	--	3,104
Nye	56	0.2	29,175	99.6	--	--	17	0.0	52	0.2	--	--	29,300
Pershing	--	--	16,712	88.1	--	--	1	0.0	2,252	11.9	--	--	18,965
White Pine	551,922	99.6	1,828	0.3	62	0.0	67	0.0	98	0.0	--	--	553,997
Region	2,415,873	92.1	168,103	6.4	1,213	0.1	2,920	0.1	34,459	1.3	205	0.1	2,622,773

T150/9-22-81/F

[1]These data were collected via a mailed questionnaire; variations in the figures may be due to a variation in the response by the agencies.

[2]Bureau of Indian Affairs recreational acreage included.

[3]Clark County, 1980 Draft.

Source: Nevada Division of State Parks, 1977.

Table 3.2.3.8-7. Utah outdoor recreation facility inventory (1976)--acres of parkland facilities.[1]

County	Federal[2]	Per-cent	State	Per-cent	Counties	Per-cent	Communities	Per-cent	Private	Per-cent	Schools	Per-cent	Total
Beaver	2,716	74.8	230	6.3	15	0.4	282	7.8	354	9.7	35	1.0	3,632
Iron	1,588	57.7	123	4.5	24	0.9	138	5.0	790	28.7	89	3.2	2,752
Juab	78,982	99.7	40	0.1	8	0.1	124	0.2	14	0.1	33	0.1	79,201
Millard	875	12.5	5,711	81.7	85	1.2	97	1.4	147	2.1	73	1.0	6,988
Piute	483	29.0	120	7.2	0	0	40	2.4	1,007	60.4	18	1.1	1,668
Salt Lake	689	5.5	2,387	19.0	1,507	12.0	1,495	11.9	4,674	37.2	1,804	14.4	12,556
Sanpete	660	22.0	98	3.3	61	2.0	64	2.1	1,716	57.1	405	13.5	3,004
Sevier	1,307	65.9	0	0	20	1.0	117	5.9	495	25.0	44	2.2	1,983
Tooele	2,303	1.2	192,361	98.3	35	0.1	99	0.1	794	0.4	158	0.1	195,750
Utah	1,559	16.1	186	1.9	0	0	1,485	15.3	5,866	60.5	601	6.2	9,697
Washington	14,815	67.8	6,407	29.3	0	0	139	0.6	409	1.9	78	0.4	21,848
Region	105,977	31.3	207,663	61.2	1,755	0.5	4,080	1.2	16,266	4.8	3,338	1.0	339,079

T151/10-5-81/F

[1]These data were collected via a mailed questionnaire; variations in the figures may be due to a variation in the response by the agencies.
[2]Bureau of Indian Affairs recreational acreage included.

Source: Institute for the Study of Outdoor Recreation and Tourism, 1976.

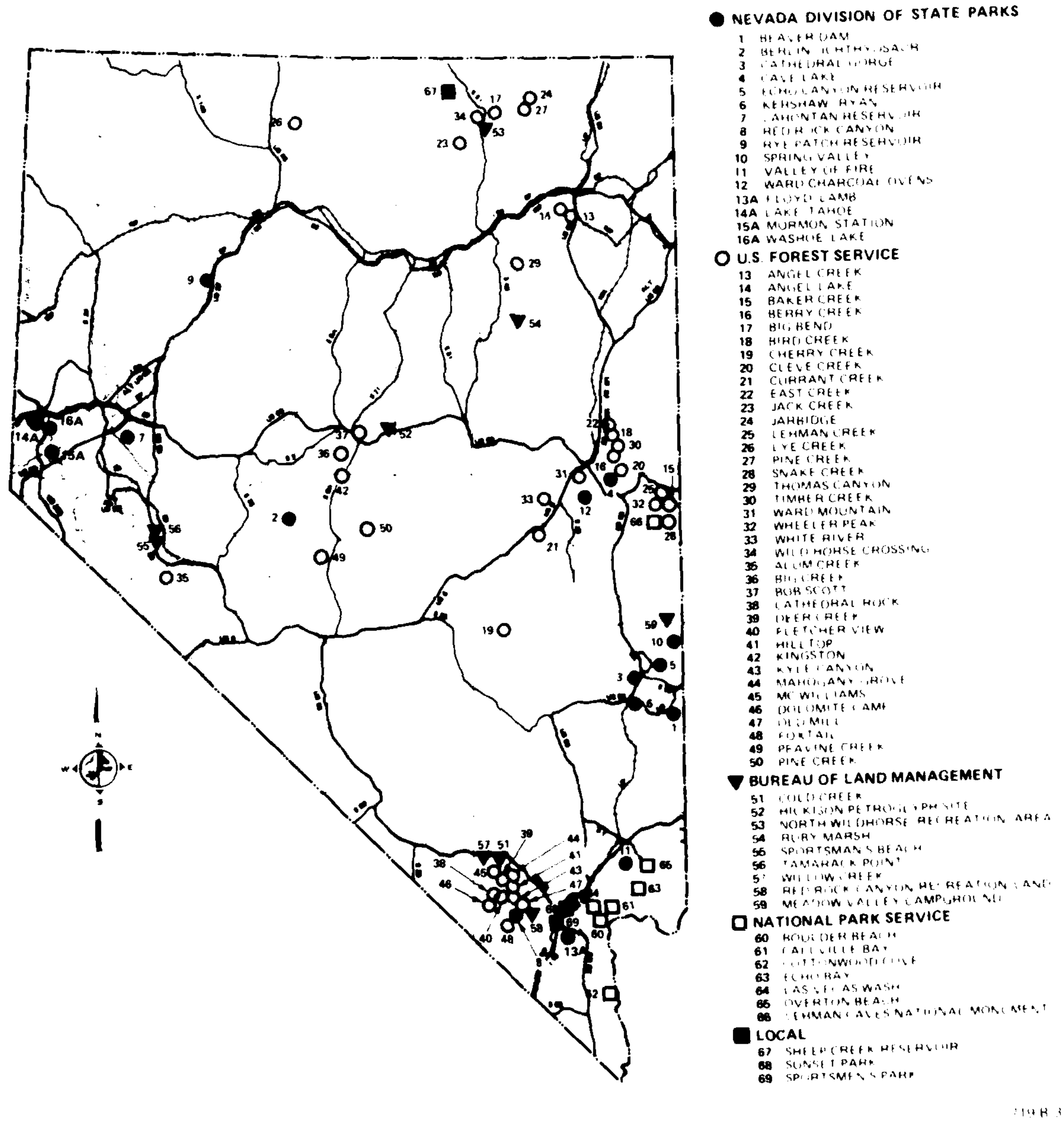

Figure 3.2.3.8-3. Major recreational areas in Nevada.

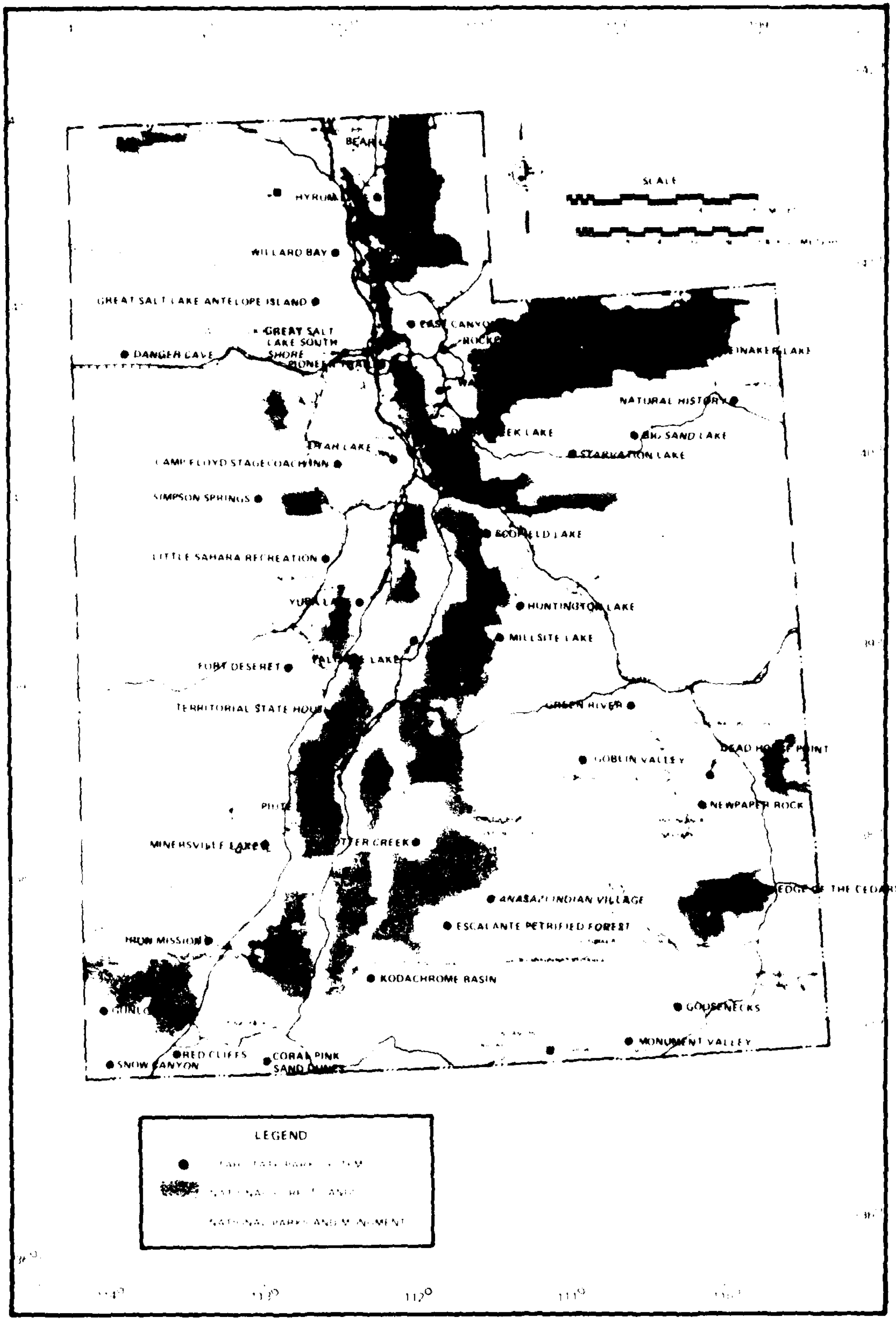

Figure 3.2.3.8-4. Major recreational areas in Utah.

Water-based Recreation

Resident participation surveys conducted since 1975 show that the four major water-oriented recreational activities--swimming, boating, fishing, and water-skiing--rank among the top recreational pursuits in the Nevada/Utah deployment area (Nevada Division of State Parks 1977; Utah Outdoor Recreation Agency, 1978). Figure 3.2.3.8-5 shows the location of water-based or water-oriented recreational areas in the project area. Areas adjacent to water bodies are popular sites for recreational activities such as picnicking and camping. Existing lakes and reservoirs in Nevada are listed in Table 3.2.3.8-8; Table 3.2.3.8-9 shows lakes in Utah. Nevada contains more than 350,000 surface acres of water in lakes and reservoirs, all capable of supporting water-based recreation. Lakes proximal to potential deployment areas (less than 60 mi) in Utah comprise more than 1 million surface acres. However, more than 75 percent of those are attributable to the presence of the Great Salt Lake, a water body of limited recreational value. Without the Great Salt Lake, more than 115,000 surface acres of water-based recreation areas on lakes are available in western Utah.

Off-Road Vehicle (ORV) Recreation

ORVs are used in conjunction with hunting, fishing, camping, sightseeing, touring, hill climbing, and racing, and are enjoyed by both local residents and tourists. Much of the Nevada/Utah region is accessible and/or attractive to ORV use. Presently, ORV activity is widespread throughout the Nevada/Utah region. Concentrated or site-intensive use such as motorcross racing and hill climbing, are rather localized around population centers and developed sites such as the Little Sahara Complex in Utah.

Hunting

Hunting of big and upland game is an important form of recreation in Nevada/Utah. Hunting waterfowl and furbearers is of lesser importance, primarily because of the limited resources present in these states.

Big game hunting is regulated by permit in both Nevada and Utah, except for mule deer and open bull elk hunting for which unlimited tags are available. Surveys of animal abundance are conducted each year to determine the number of permits to be issued for each management unit. Population levels of most game animals have shown moderate to large population fluctuations over time as a result of numerous factors, particularly those related to human activities. Figures 3.2.3.8-6 and 3.2.3.8-7 and Tables 3.2.3.8-10 and 3.2.3.8-11 show harvest data for big game animals in Nevada and Utah. Figures 3.2.3.8-8 through 3.2.3.8-12 show big game management areas for Nevada/Utah.

Upland game harvest has shown moderate to large annual fluctuations related to population trends, with dove harvest generally increasing over the past 25 years in both states. Sage grouse harvest in Utah has increased in the last 10 years, as have harvests of fox and coyote in Nevada (Tables 3.2.3.8-12 through 3.2.3.8-14).

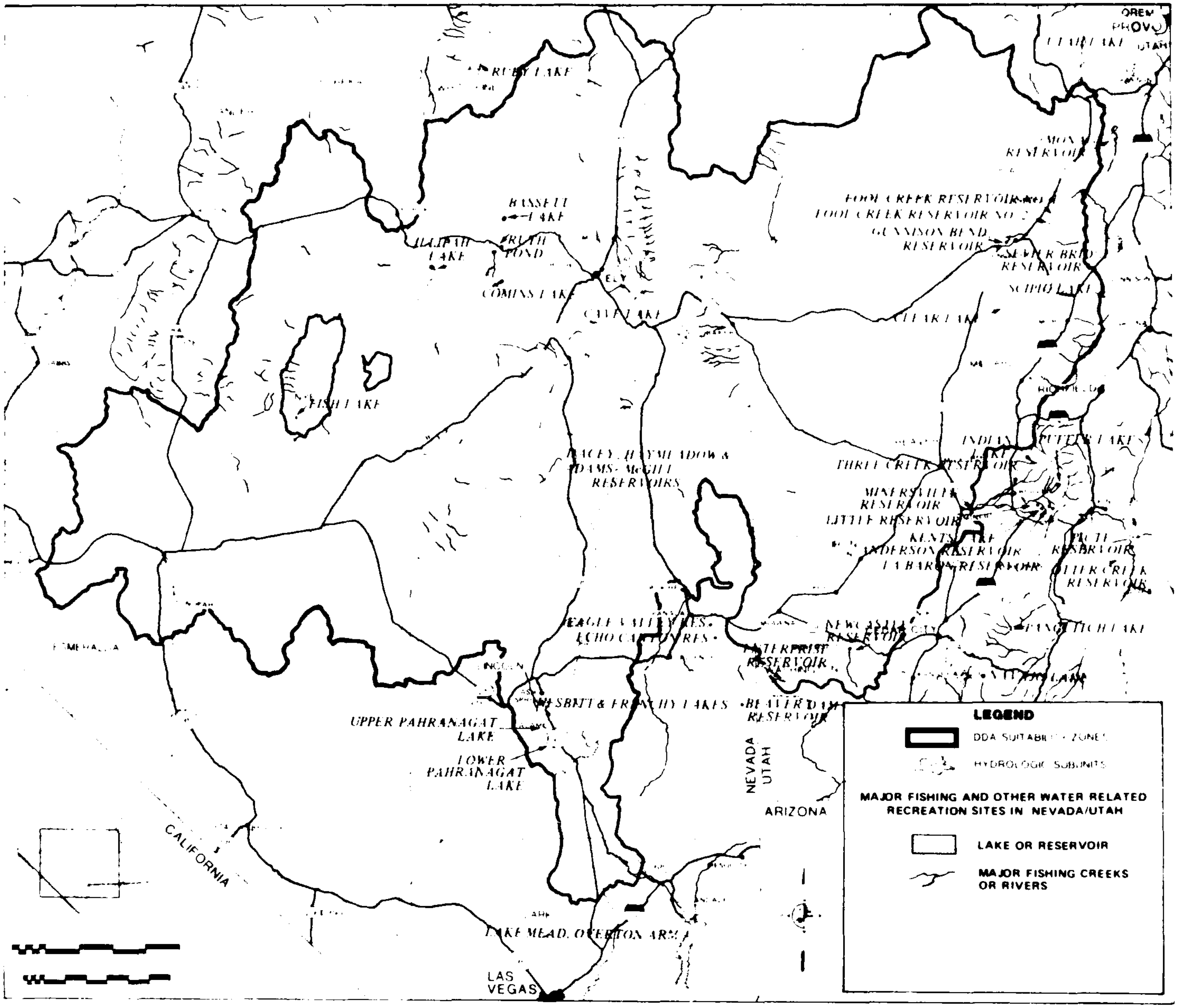

Figure 3.2.3.8-5. Selected water-based recreational areas in the Nevada/Utah study area.

Table 3.2.3.8-8. Rank order of existing lakes and reservoirs that support water-oriented recreation in the Nevada study area by size (Page 1 of 2).

Lake/Reservoir	Surface Acres
Nevada	
Washoe, Storey, Churchill, Lyon, Carson City and Douglas counties	
Pyramid	108,000
Tahoe[1]	36,400
Lahontan	14,800
Washoe (Big and Little)	6,100
Stillwater Point	1,900
Topaz[1]	1,250
Indian Lakes	700
Big Soda Lake	400
Ft. Churchill Cooling Ponds	200
Tracy Pond	30
Paradise Lake	25
Virginia Lake	24
Nye, Esmeralda, and Mineral counties	
Walker[2]	38,800
Weber Reservoir[2]	950
Dacey and Adams-McGill[2]	791
Haymeadow Reservoir[2]	203
Clark County	
Mead[2]	100,000
Mohave[1]	14,100
Eureka, White Pine, and Lincoln counties	
Ruby Marsh[2]	3,000
Pahranagat Lakes[2]	800
Bassett Lake[2]	120
Echo Reservoir[2]	65
Spring Valley Reservoir[2]	59
Cave Lake[2]	32
Illipah Reservoir[2]	30

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Table 3.2.3.8-8. Rank order of existing lakes and reservoirs that support water-oriented recreation in the Nevada study area by size (Page 2 of 2).

Lake/Reservoir	Surface Acres
Nevada	
Eureka, White Pine, and Lincoln counties (continued)	
Beaver Dam[2]	20
Comins Lake[2]	20
Silver Creek Reservoir[2]	13
Tonkin Reservoir[2]	4
Elko County	
Ruby Marsh[2]	4,000
Wildhorse	2,830
Sheep Creek Reservoir	885
Wilson Reservoir	827
Willow Creek Reservoir	761
Bull Run Reservoir	106
Deep Creek Reservoir	92
Liberty Lake[2]	21
Overland Lake[2]	20
Favre Lake[2]	19
Robertson Lake	17
Angel Lake[2]	13
Hidden Lake	9
Island Lake	7
Lander, Pershing, and Humboldt counties	
Rye Patch	11,400
Chimney Creek Reservoir	2,000
Summit Lake	560
Onion Valley	100
Knott Creek Reservoir	100
Little Onion	30
Duferena Ponds	25
Smith Reservoir	20
Groves Lake	17
Iowa Reservoir	15
Blue Lakes	11
Nevada Total	351,722

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[1]Averages shown here are estimates of areas on the Nevada portion of these lakes.

[2]Denotes that water body is proximal to potential deployment areas (less than 60 mi).

Note: Many small lakes and reservoirs in the region are not included.

Source: Nevada Division of State Parks, 1977.

Table 3.2.3.8-9. Rank order of existing lakes and reservoirs that support water-oriented recreation in the Utah study area by size.

Lake/Reservoir	Surface Acres
Utah	
Great Salt Lake[1]	960,000
Lake Powell	168,250
Utah Lake[1]	95,900
Bear Lake	71,000
Flaming Gorge Reservoir	13,690
Yuba Lake[1]	10,700
Willard Bay	9,920
Strawberry Reservoir	8,400
Cutler Reservoir	7,184
Pine View Reservoir	4,900
Nine Mile Reservoir	3,015
Scofield Lake	2,804
Starvation Lake	2,760
Otter Creek Lake	2,520
Fish Lake	2,500
Deer Creek Lake[1]	2,435
Piute Lake[1]	2,250
Echo Reservoir	1,484
Panguitch Lake[1]	1,234
Minersville Lake[1]	1,130
Rockport Lake	1,030
Joe's Valley Reservoir	954
Steinaker Lake	795
Funnison Bend Reservoir	706
East Canyon Lake	681
Navajo Lake[1]	618
Hyrum Lake	457
Millsite Lake	435
Big Sand Lake	393
Lost Creek Lake	365
Gunlock Lake[1]	240
Huntington Lake	237
Newcastle Reservoir[1]	162
Palisade Lake[1]	31
Fish Lake[1]	1,900
Enterprise[1]	Unknown
Soldier Creek Reservoir	Unknown
Electric Lake	Unknown
Newton Reservoir	Unknown
Utah Total	1,353,657

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[1]Denotes that water body is proximal to potential deployment areas (less than 60 mi).

Note: Many small lakes and reservoirs in the region are not included.

Sources: Utah Bureau of Economic and Business Research, January, 1979. State of Utah Division of Wildlife Resources, 1980.

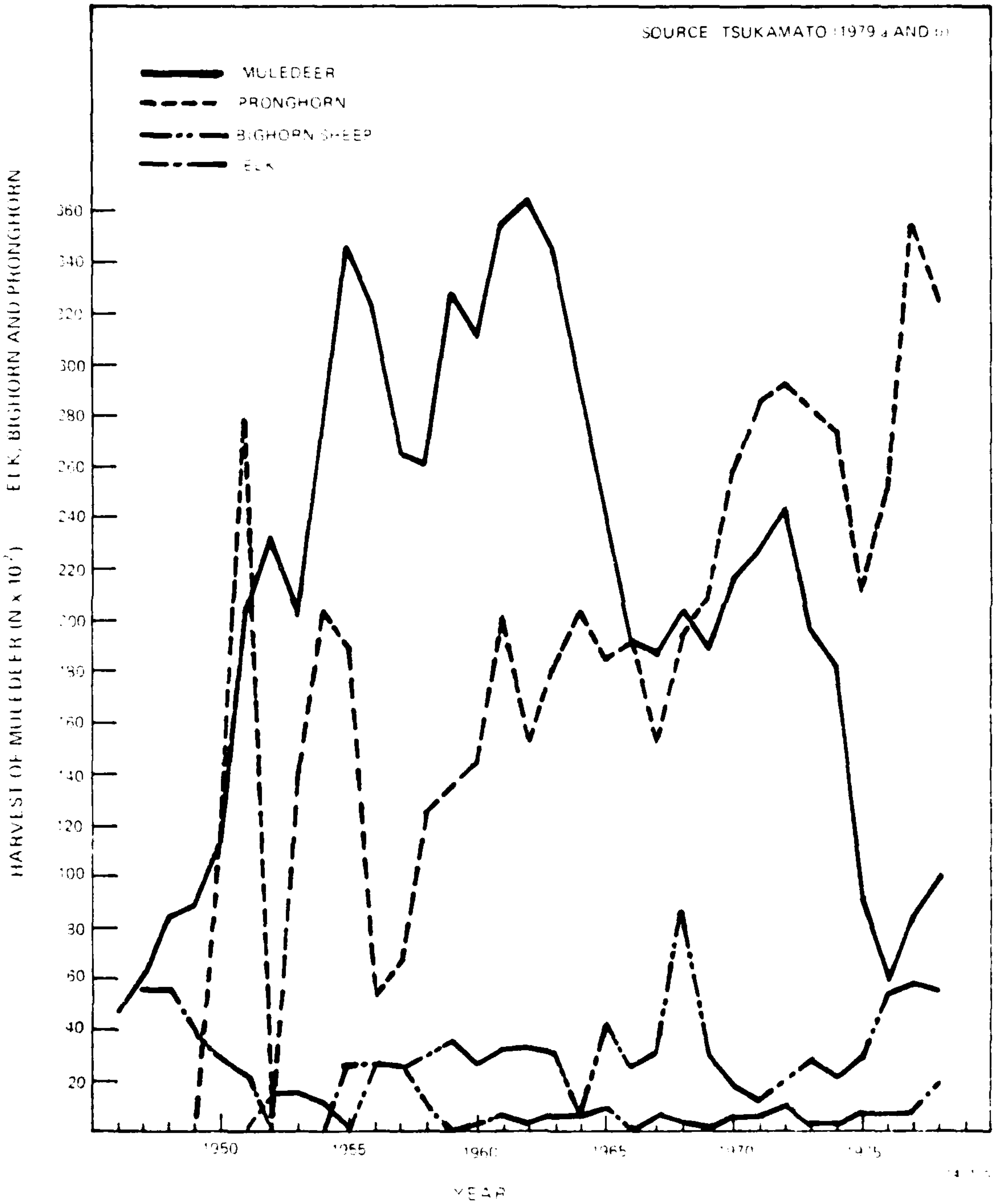

Figure 3.2.3.8-6. Big game harvest in Nevada.

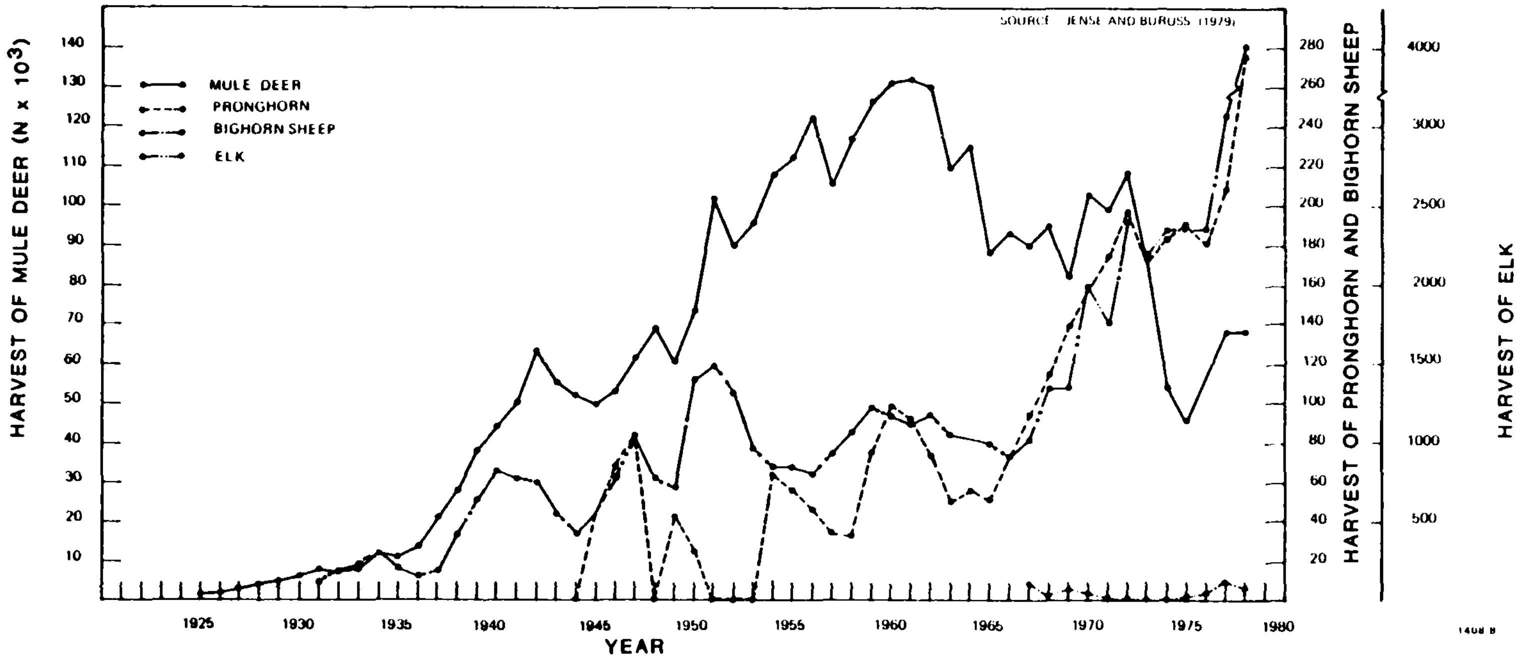

Figure 3.2.3.8-7. Big game harvest in Utah.

Table 3.2.3.8-10. Pronghorn, bighorn sheep, and elk harvest by management unit for 1978 for those areas in the study area.

Management Area[1]	Pronghorn		Bighorn Sheep		Elk	
	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters
Nevada						
10	10	11				
11	21	29			19	20
16	3	5				
20		Closed				
22		Closed				
23	6	10				
25A	7	7				
25B	4	5				
70			3	3		
71			2	5		
73			3	4		
74			4	7		
75			4	4		
76			6	6		
77			4	6		
78			6	6		
79			2	6		
80			8	12		
Sub Total	51		42			
State Total	324	387	55	81	19	20
Utah						
Cedar City	5	5				
Southwest Desert	29	35				
West Desert Riverbed	12	15				
Snake Valley	12	15				
4					17	20
18					1	10
Sub Total	58		0		18	
State Total	276	320	7	23	4,093	33,564

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[1] See Figures 3.2.3.8-7 and 3.2.3.8-8 for management area locations.

Source: Tsukamoto, 1979b; Jense and Burruss, 1979.

Table 3.2.3.8-11. Mule deer and mountain lion harvest by management area for 1978 for those areas within the study area (Page 1 of 2).

Management Area[1]	Mule Deer[2]		Mountain Lion	
	Harvest	Number Hunters	Harvest	Number Hunters
Nevada				
8			10	20
9			4	14
10	1,423	3,048	3	12
11	958	2,605	2	20
12	184	404	1	6
13	376	1,000		
14	421	942		
15	210	509	0	4
16	386	959	1	10
17	226	643	0	4
18	37	100	3	12
19			0	10
20	236	589	5	14
21	30	95	2	8
22	308	772	0	4
23	175	542	1	5
24	122	275	0	5
25	19	43	0	3
Sub Total	5,111		32	
State Total	10,169	23,257	39	202

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Table 3.2.3.8-11. Mule deer and mountain lion harvest by management area for 1978 for those areas within the study area (Page 2 of 2).

Management Area[1]	Mule Deer[2] Harvest	Mule Deer[2] Number Hunters	Mountain Lion Harvest	Mountain Lion Number Hunters
Utah				
11	1,655	4,755	0	0
12	985	3,341	0	5
13	827	2,786	0	1
14	388	1,571	0	0
53	293	1,351	1	12
54	566	1,927	5	4
55	1,006	2,786	10	10
56A	303	1,140	3	10
56B	142	495	2	10
56C	368	1,303	6	22
62A	152	566	4	7
62B	86	192	1	1
62C	118	310	4	10
Sub Total	6,889		36	
State Total	68,282	216,951	N.D.[3]	N.D.

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[1] Management areas for mule deer and mountain lion do not have the same boundaries although numbered the same. See Figures 3.2.3.8-10 and 3.2.3.8-11.

[2] Harvest includes regular license, control permits, and primitive weapons.

[3] No data available.

Source: Tsukamoto, 1979a&b; Jense and Burruss, 1979; Utah DWR, 1981 comments on DEIS.

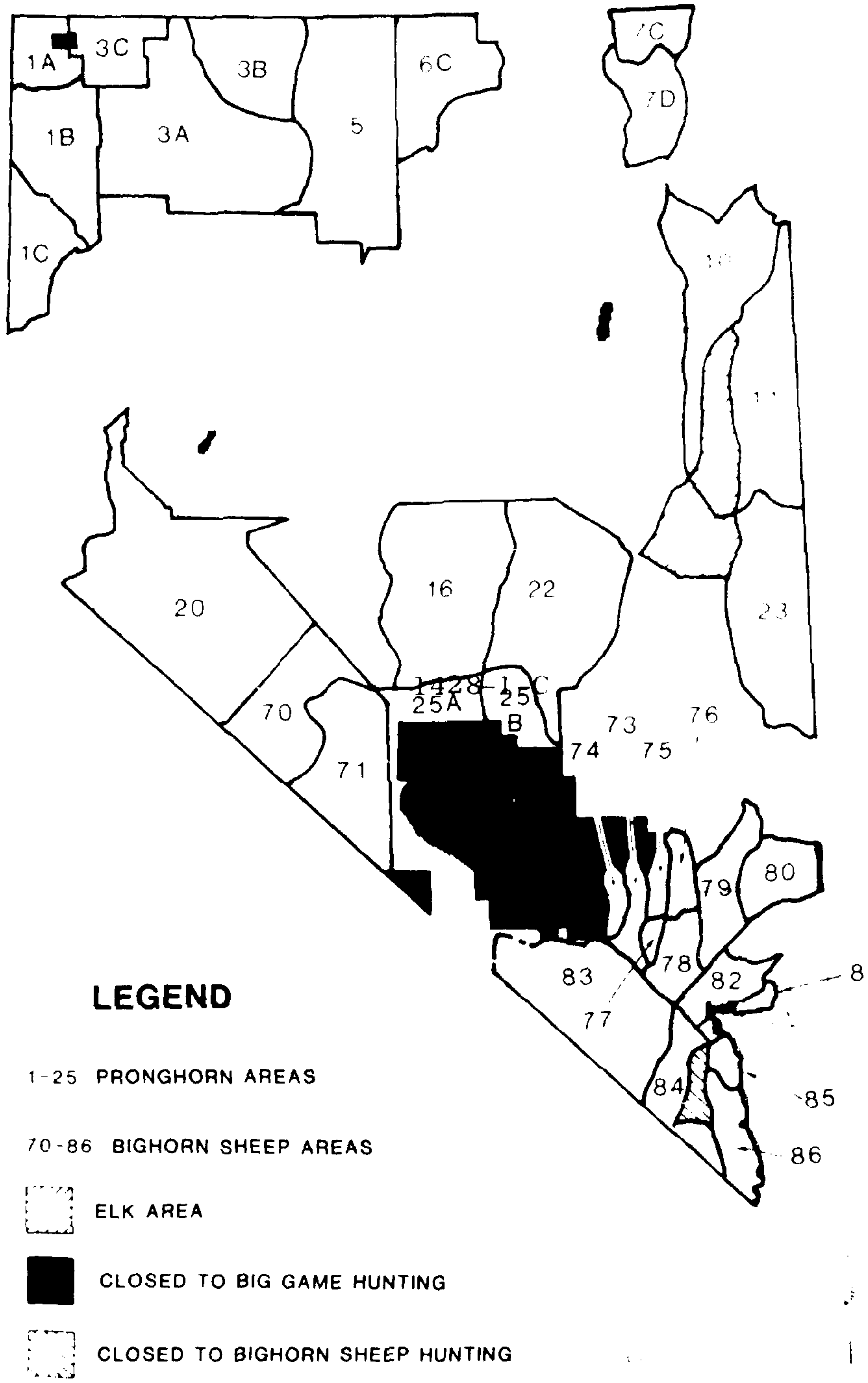

Figure 3.2.3.8-8. Pronghorn, bighorn sheep and elk management areas in Nevada.

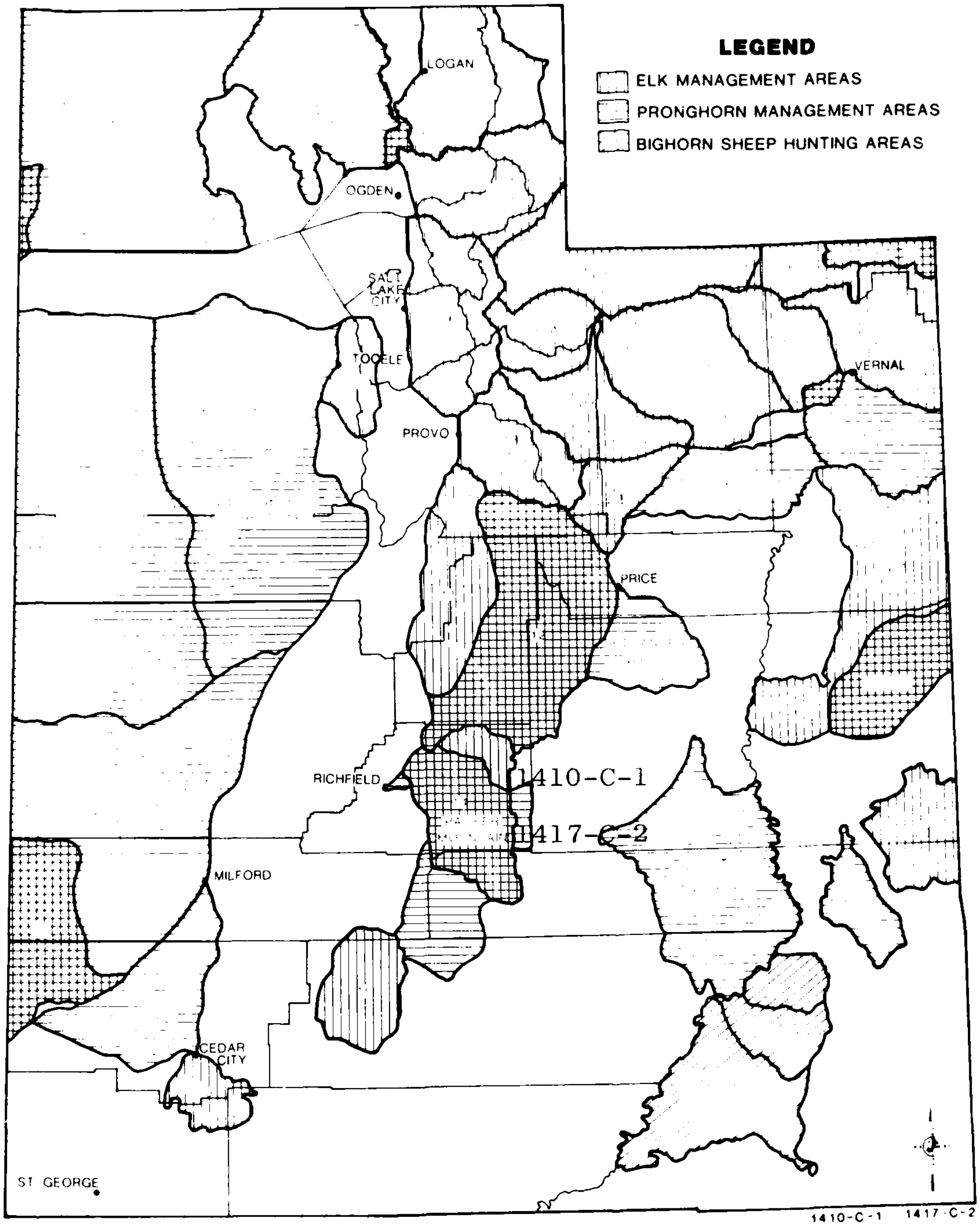

Figure 3.2.3.8-9. Big game management areas in Utah.

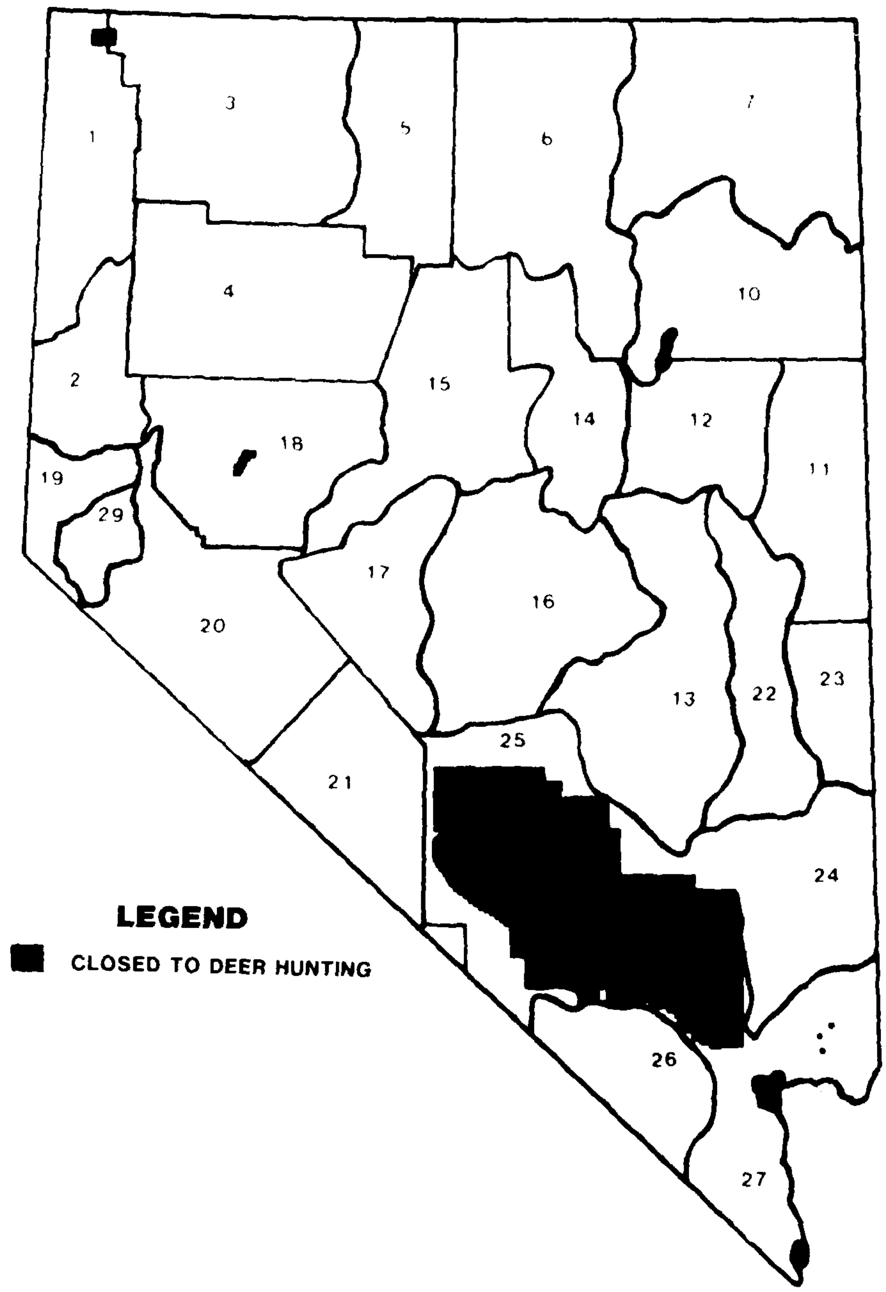

Figure 3.2.3.8-10. Mule deer management units in Nevada.

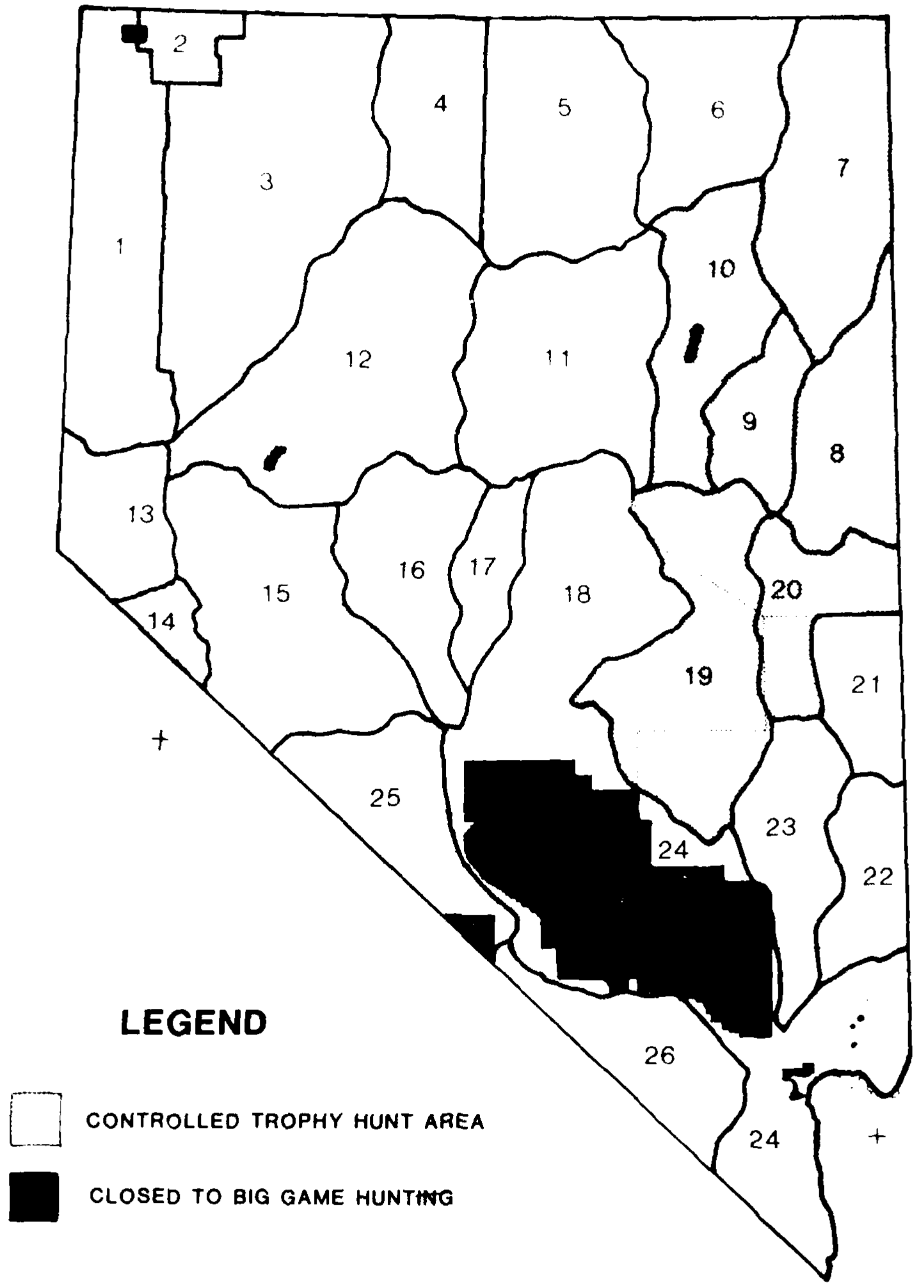

Figure 3.2.3.8-11. Mountain lion management areas in Nevada.

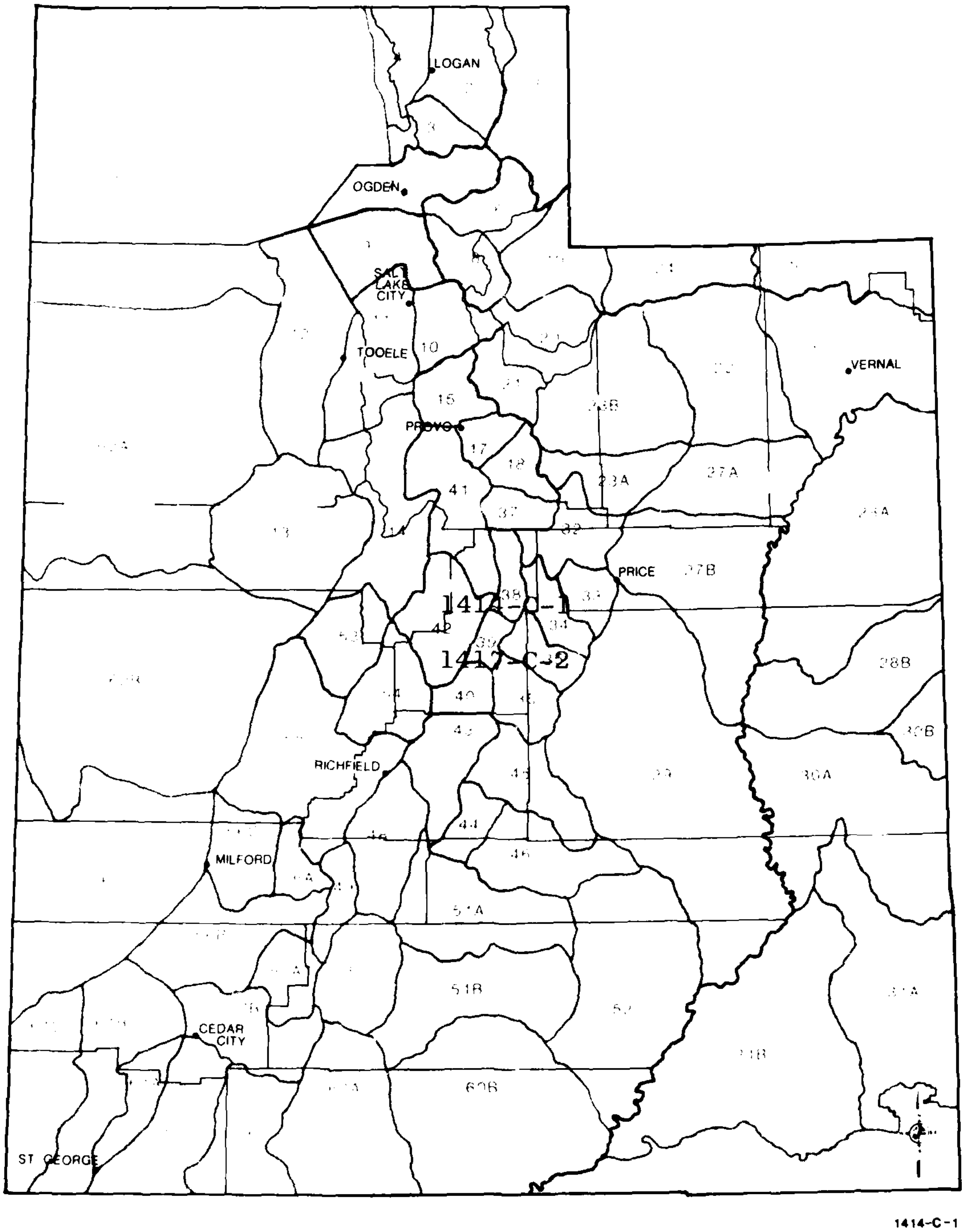

Figure 3.2.3.8-12. Mule deer management areas in Utah.

Table 3.2.3.8-12. Upland game harvest by county in 1978 for the Nevada/Utah study area.

County	Sage Grouse		Chukar		Quail		Dove		Rabbit		Other[1]	
	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters
Nevada												
Clark	13	3	462	100	39,750	3,376	41,340	2,872	31,017	3,071	135	257
Elko	6,722	2,122	12,296	1,493	65	31	2,558	325	6,304	962	2,718	987
Esmeralda	0	1	2,470	349	40	5	753	92	603	91	0	0
Eureka	1,153	368	2,456	400	366	44	897	134	442	84	57	44
Lander	1,724	880	3,708	588	154	80	445	78	2,739	290	482	212
Lincoln	0	0	124	63	9,181	816	8,155	556	9,218	746	4	4
Mineral	244	152	4,375	442	274	50	1,373	127	2,075	284	48	14
Nye	1,939	720	7,743	1,166	3,342	478	13,325	1,114	6,925	983	77	75
White Pine	1,596	640	287	97	0	0	2,874	229	5,541	607	871	400
Subtotal	13,301		33,921		53,172		71,720		55,646		4,392	
State Total	17,693	6,765	108,775	14,561	104,939	9,765	113,048	9,860	99,817	11,628	10,219	5,251
Utah												
Beaver	360	174	0	11	0	0	6,465	317	3,562	345	1,721	496
Iron	300	229	0	11	0	26	16,132	997	4,564	673	3,303	1,102
Juab	240	153	580	277	120	17	34,065	2,112	20,684	1,555	3,282	1,433
Millard	40	44	981	301	80	78	35,606	1,922	6,648	790	10,367	3,351
Tooele	260	261	11,008	3,108	0	35	23,697	2,051	40,788	3,716	6,825	2,729
Subtotal	1,200		12,569		200		115,965		192,211		25,498	
State Total	25,938	16,231	65,747	16,291	15,491	5,924	383,696	35,985	401,071	35,590	314,925	113,861

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[1] Includes pheasant, blue and ruffed grouse, and Hungarian partridge.

Sources: Molini and Barngrover, 1979; Leatham and Bunnell, 1979.

Table 3.2.3.8-13. Furbearer harvest by county in 1978 for selected counties in the study area.

County	Bobcat		Fox[1]		Coyote		Muskrat		Beaver		Other[2]	
	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters
Nevada												
Clark	526		457		527		200		0		91	
Elko	357		106		1,760		2,760		266		312	
Esmeralda	130		18		65		0		0		8	
Eureka	107		21		243		6		13		16	
Lander	353		27		297		0		6		46	
Lincoln	523		443		1,002		115		0		93	
Mineral	199		292		296		37		42		29	
Nye	308		230		389		1		1		79	
White Pine	211		136		416		1,192		13		60	
Subtotal	2,714		1,730		5,095		4,311		341		734	
State Total	4,542	909	2,322	909	8,458	909	9,898	909	715	909	1,261	909
Utah												
Beaver							N/A	N/A	1	0		
Iron							N/A	N/A	4	0		
Juab							N/A	N/A	8	3		
Millard							349	N/A	0	0		
Tooele							N/A	N/A	0	0		
Subtotal							349		13			
State Total	N/A[3]	N/A	N/A	N/A	N/A	N/A	11,790	N/A	2,958	218	279	76

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[1]Gray and kit fox.

[2]Includes ringtail cat, mink, otter, skunk, weasel, raccoon, and badger in Nevada; marten and mink in Utah.

N/A = Not available in state harvest reports.

Sources: Molini and Barngrover, 1979; Provan, 1979.

Table 3.2.3.8-14. Waterfowl harvest data by county in 1978 for the Nevada/Utah study area.

State/ County	Ducks		Geese		Coots	
	Harvest	Number Hunters	Harvest	Number Hunters	Harvest	Number Hunters
Nevada						
Clark	8,369	1,262	443	1,262	367	206
Elko	5,536	666	166	666	0	0
Esmeralda	43	6	2	6	21	3
Eureka	1,100	119	7	119	9	9
Lander	202	73	0	73	3	3
Lincoln	6,513	898	68	898	748	136
Mineral	1,958	113	496	113	0	0
Nye	5,508	837	128	837	553	84
White Pine	1,051	201	5	201	0	0
Sub-total	30,280		1,315		1,701	
State Total	104,840	12,452	6,940	12,452	3,184	805
Utah						
Beaver	3,179	504	635	504		
Iron	946	229	237	229		
Juab	4,452	930	1,048	930		
Millard	3,486	673	466	673		
Tooele	3,021	463	542	463		
Sub-total	15,102		2,928			
State Total	330,227	40,877	49,212	40,877	NA [1]	NA

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[1] No data available.

Source: Molini and Barngrover, 1979; Utah DWR, 1981.

Fishing

Sport fishing is one of the most popular recreation activities in Nevada and Utah. Table 3.2.3.8-15 is a list of the game fish in Nevada and Utah. Existing supplies of lake acres suitable for fishing in the states of Nevada and Utah are 351,287 surface acres and 441,400 surface acres, respectively (Nevada Division of State Parks, 1977; Utah Outdoor Recreation Agency, 1978). Stream, river, lake, and reservoir fisheries classification, length, and dominant species by hydrologic subunit are indicated in Tables 3.2.3.8-16 and 3.2.3.8-17. The annual change in Nevada gamefish effort and harvest is shown in Table 3.2.3.8-18. In the four years indicated there has been a decrease in the numbers of anglers; however, there has been an increase in the time spent fishing. The success ratio per unit of time (fish/day) has decreased indicating a trend of greater pressure on the fisheries resources in Nevada.

Snow-Related Activities

Snow-related recreational activities in Nevada and Utah consist mainly of downhill and cross-county skiing, snowshoeing, snow-mobiling, and free play. These activities are primarily concentrated in three main areas in Nevada and Utah: the Nevada/California border (Lake Tahoe area), the Mt. Charleston area (Clark County), and the national forests in central Utah. To a lesser extent, all other U.S. Forest Service holdings and other mountainous lands within the study area also are used for snow activities; however, because of their distance from large population centers and the abundance of higher quality alternatives, the demand is much less. Such areas include east-central Lincoln County, Toiyabe National Forest in Nye, Lander, and Eureka counties, and Humboldt National Forest in White Pine County.

Native American Resources (3.2.3.9)

Cultural Resources (3.2.3.9.1)

Ancestral Sites and Occupation Areas

The area was occupied in late prehistoric and early historic times by the Shoshone, Southern Paiute, and Ute tribes (Figure 3.2.3.9-1). Much of the area lies in Shoshone traditional lands and Southern Paiute traditional lands in southeastern Nevada and southwestern Utah. Portions of the Sevier Desert, Desert-Dry Lake sub-area, and northern Milford Valley were occupied by the Western Ute in prehistoric and early historic times.

Sacred Areas

Sites with religious importance include burial grounds, cremation areas, rock art, mineral deposits, special caves, lakes and springs, and selected physiographic features. In the broadest sense, the entire ancestral territory of each tribal group is sacred.

Gathering and Hunting Areas

Native flora and fauna are regularly used by Native Americans for food, medicine and other purposes (See Tables 3.2.3.9-1, -2). As in ancestral times, pine

Table 3.2.3.8-15. Game fish in Nevada and Utah (Page 1 of 2).

Common Name	Scientific Name	Nevada	Utah
Salmon, Trout, Grayling and Whitefish	Family SALMONIDAE		
Chinook salmon	Oncorhynchus tshawytscha	X	
Sockeye (kokanee) red salmon	O. nerka kennalyi	X	X
Lake trout	Salvelinus namaycush	X	X
Brook trout	S. fontinalis	X	X
Bull trout	S. confluentus	X	
Cutthroat trout	Salmo clarki		
Lahontan cutthroat trout	S. c. henshawi	FT	FT
Colorado cutthroat trout	S. c. pleuriticus	X	X
Bonneville cutthroat trout	S. c. utah	SE	X
Yellowstone cutthroat trout	S. c. lewisi	X	X
Rainbow trout	S. gairdneri		X
Southcoast rainbow trout	S. g. irideus	X	
Kamloops rainbow trout	S. g. kamloops	X	
Golden trout	S. aquabonita	X	X
Brown trout	S. trutta		X
Arctic grayling	Thymallus arcticus		X
Mountain whitefish	Prosopium williamsoni	X	X
Bonneville cisco	P. gemmiferum		X
Bonneville whitefish	P. spilonotus		X
Bear Lake whitefish	P. abyssicola		X
Pike	Family ESOCIDAE		
Northern pike	Esox lucius		X
North American Catfish	Family ICTALURIDAE		
Channel catfish	Ictalurus punctatus	X	X
White catfish	I. catus	X	
Brown bullhead	I. nebulosus	X	
Black bullhead	I. melas	X	X
Yellow bullhead	I. natalis		X
Flathead catfish	Pylodictis olivaris		
Perch	Family PERCIDAE		
Yellow perch	Perca flavescens	X	X
Walleye	Stizostedion vitreum vitreum		X

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Table 3.2.3.8-15. Game fish in Nevada and Utah (Page 2 of 2).

Common Name	Scientific Name	Nevada	Utah
Sunfish	Family CENTRARCHIDAE		
Sacramento perch	Archopites interruptus	X	X
Largemouth bass	Micropterus salmoides	X	X
Smallmouth bass	M. dolomieui	X	X
Striped bass	Morone saxatilis	X	X
White bass	M. chrysops	X	X
Bluegill	Lepomis macrochirus	X	X
Green sunfish	L. cyanellus	X	X
Black crappie	Pomoxis nigromaculatus	X	X
White crappie	P. annularis	X	X

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Note: FT = federally listed threatened species, caught as gamefish in Nevada and Utah.
SE = state listed endangered species in Utah, caught as gamefish in Nevada.

Table 3.2.3.8-16. Lake and reservoir classification and distribution of fish by hydrologic subunit in the Nevada-Utah study area (Page [illegible] of 3).

Hydrologic Subunit Lake or Reservoir	Surface Area (acres)	Value Class	Stocked Species	Other Species	Depth (ft) Maximum	Depth (ft) Mean	Temperature (°C) Maximum	Temperature (°C) Mean
[illegible] Valley (#1[illegible])								
Canyon Lake	36	3		Rainbow trout, Utah chub	35	[illegible]	[illegible]	
[illegible] Valley (#12)								
Settlement Canyon Reservoir		3	Rainbow trout	Brown trout, black bullhead				
Great Salt Lake Desert (#23)								
[illegible] Reservoir	[illegible]	3	Cutthroat trout	Brook trout	[illegible]	5		
[illegible] (#46)								
[illegible] Bend Reservoir	756	3	Walleye	Carp, white bass, channel catfish, cutthroat trout	12			
[illegible] Reservoir				Yellow perch, carp, Utah chub				
[illegible] Lake	300	3		Carp, Utah sucker, threadfin shad				
[illegible]		4		Brook trout, rainbow trout	8			
[illegible]								
[illegible] Lake	10	4	Rainbow trout		33	13		
[illegible] Lake	35	4	Rainbow trout		9	16		
[illegible] Reservoir		3	Walleye	Yellow perch	80			
[illegible] Lake	2	3	Rainbow trout					
[illegible]								
[illegible] Lake	40	3	Rainbow and brook trout		50	6		
[illegible] Reservoir	3		Cutthroat trout		8			
[illegible] Reservoir	28[illegible]-495	2	Rainbow trout		54		22	
[illegible] Reservoir	24	3	Arctic grayling, rainbow and brook trout		21			
[illegible] Lake [illegible]	7	3	Brook trout		3	2	19	
[illegible] Lake [illegible]	43	3		Rainbow trout			20	
[illegible] Reservoir	22	3						

[illegible]

Table 3.2.3.8-16. Lake and reservoir classification and distribution of fish by hydrologic subunit in the Nevada/Utah study area[1] (Page 2 of 3).

Hydrologic Subunit Lake or Reservoir	Surface Area (acres)	Value Class	Stocked Species	Other Species	Depth (ft) Maximum	Depth (ft) Mean	Temperature Maximum	Temperature Mean
Near Dixie Creek (#43)								
Piute Reservoir	2,510	3		Rainbow trout, brown trout, Utah chub, carp, Utah sucker, redside shiner	60		19	
Otter Creek Reservoir	2,521	3	Rainbow trout	Utah chub	36		21	
Manning Meadow Reservoir	55	3	Cutthroat trout		49		22	
Box Creek Reservoir Upper	[illegible]	3	Rainbow and brook trout		18		17	
Box Creek Reservoir Lower	50	3	Rainbow and brook trout		23		18	
[illegible] Reservoir	[illegible]	4	Rainbow trout					
[illegible]	1			Cutthroat trout	5			
[illegible] Lake	5	3	Rainbow and brook trout				14	
[illegible] Lake	2	4	Rainbow trout					
[illegible] Reservoir	4	3	Rainbow trout	Leather side chub, redside shiner	14		18	
Anderson Meadow Reservoir	3	3	Rainbow and brook trout		21		17	
[illegible] (#44)								
[illegible] Meadow Reservoir	[illegible]	3	Rainbow and brook trout		26			
[illegible] Valley Pond			Brook trout					
[illegible] Reservoir	[illegible]	3	Rainbow trout		33		21	
[illegible] Lake	2	3	Brook trout		10			
[illegible] Lake		3	Brook trout		5			
Twin Lake Upper			Brook trout	Cutthroat trout	4		14	
Twin Lake Lower			Brook trout		5		18	
Near Panguitch Valley (#45)								
Tropic Reservoir	90-180	3	Rainbow and cutthroat trout		23		18	
Tropictown Lake	3	3		Cutthroat trout	10	7	21	
Pine Lake	77	3	Rainbow and cutthroat trout		30	12	18	
Panguitch Lake	770-1,234	1	Rainbow trout		33			

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Table 3.2.3.8-16. Lake and reservoir classification and distribution of fish by hydrologic subunit in the Nevada/Utah study area[1] (Page 3 of 3).

Hydrologic Subunit Lake or Reservoir	Surface Area (acres)	Value Class	Stocked Species	Other Species	Depth (ft) Maximum	Depth (ft) Mean	Temperature (°C) Maximum	Temperature (°C) Mean
Near Cedar City Valley (#51)								
Woods Pond	1	3	Rainbow trout		6			
Mary's Creek (#52)								
Big Hollow Upper	3	3	Cutthroat and brook trout		16	6	18	
Beryl Enterprise (Pine Valleys) (#53)								
Enterprise Reservoir Upper	200	3		Redside shiner	60		22	
Enterprise Reservoir Lower	30	3	Rainbow trout		48		21	
Calf Creek Reservoir	5	3		Cutthroat trout	17	2	17	
Newcastle Reservoir		3	Rainbow trout		72		4	
White River Valley (#207)								
Adams-McGill Reservoir			Rainbow, brook and brown trout, largemouth black bass, white crappie					
Pahranagat Valley (#209)								
Pahranagat Lake Upper			Largemouth black bass	Green sunfish				
Near Black Mountains Valley (#215)								
Lake Mead			Rainbow trout, silver salmon, green sunfish, channel catfish, striped bass, largemouth black bass, black crappie, bluegill, black bullhead					
Steptoe Valley (#179)								
Comins Lake			Rainbow, brown and black trout, northern pike, largemouth black bass					
Cave Lake			Rainbow, brown and black trout, northern pike, largemouth black bass					

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[1] Blank spaces indicate data are unavailable.

Source: State of Utah, 1980.

Table 3.2.3.8-17. Stream classification and distribution of game fish and selected nongame fish by hydrologic subunit in the Nevada/Utah study area[1] (Page 1 of 5).

Hydrologic Subunit Stream	Length (mi)	Value Class[2]	Dominant Species	Stocked
Snake Valley, Nev./Utah (#4)				
Baker Creek	9	3-I	Brook, Rainbow, Bonneville Cutthroat Trout	Annually
Deep Canyon Creek	4	2-I	Bonneville Cutthroat Trout	None
Hampton Creek	7.5	2-I	Bonneville Cutthroat Trout	None
Hendries Creek	11	2-I	Utah Cutthroat Trout	None
Lehman Creek	11	3-I	Brown, Rainbow, Bonneville Cutthroat Trout	Annually
Silver Creek	21	3-I	Brown, Rainbow, Bonneville Cutthroat Trout	None
Smith Creek	12	3-II	Rainbow Trout	None
Snake Creek	18.5	3-I	Rainbow Trout	Annually
Spring Creek	0.8	3-II	Rainbow Trout	None
Strawberry Creek	7	3-II	Brook, Rainbow, Bonneville Cutthroat Trout	None
Birch Creek	4	1	Rainbow, Bonneville Cutthroat Trout	None
Burnt Cedar Creek	5	2	Rainbow, Cutthroat Trout	None
Granite Creek	4	3	Rainbow Trout	
Thomas Creek	7	2	Rainbow Trout	None
Trout Creek	0.7	1	Rainbow, Bonneville Cutthroat Trout	None
Sevier Desert Valley, Utah (#46)				
Sevier River, in part	48	5	None	None
Sevier River, in part	12	4	Yellow Perch, Largemouth Bass, Bluegill, Walleye, White Bass, Crappie	
Oak Creek	8.5	3		Rainbow
Pioneer Creek	6.0	3		Rainbow
Chalk Creek	3.5	3/4		Rainbow
Meadow Creek	3.5	3		Rainbow
Corn Creek	9.0	3		Rainbow, Brown
Pine Creek			None	
Wild Goose Creek			None	
Maple Hollow Creek			None	
Whiskey Creek			None	
Huntington Valley, Nev. (#47)				
Box Canyon Creek	7.0	2-I	Brook, Lahontan Cutthroat Trout	
Brown Creek	6.0	3-II	Brook Trout	
Carville Creek	5.5	2-I	Lahontan Cutthroat Trout	
Cave Creek	0.3	3-II	Brook Trout	
Corral Creek	38	3-I, 3-II	Brook Trout	
Cottonwood Creek	7	3-II	Rainbow Trout	
Echo Canyon Creek	4.5	2-I	Lahontan Cutthroat Trout	
North Furlong Creek	6.3	2-I, 3-I	Brook, Lahontan Cutthroat Trout	
Gennette Creek	5.0	2-I, 3-I	Brook, Lahontan Cutthroat Trout	
Gilbert Creek	8.0	2-I, 3-I	Brook, Lahontan Cutthroat Trout	
Green Mountain Creek	11.0	2-I, 3-I	Brook, Lahontan Cutthroat Trout	
Humboldt River South Fork	28	2-II, 3-I	Brook, Lahontan Cutthroat, Rainbow Trout	Cutthroat
Kleckner Creek	9	2-I, 3-I	Brook, Lahontan Cutthroat Trout	
Lindsay Creek	11	3-III	Rainbow Trout	
Little Humboldt River, South Fork	25	2-I	Brook, Lahontan Cutthroat Trout	
Mahogany Creek	2.5	2-I	Lahontan Cutthroat Trout	
McCutcheon Creek	8.5	2-II, 3-II	Brook, Lahontan Cutthroat Trout	
Mitchell Creek	10.0	2-I	Lahontan Cutthroat Trout	Cutthroat
Pearl Creek	11.5	2-II, 3-I	Brook, Lahontan Cutthroat Trout	
Rattlesnake Creek	10.5	2-I, 3-I	Brook, Lahontan Cutthroat Trout	
Segunda Creek	3.5	2-I	Lahontan Cutthroat Trout	

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Table 3.2.3.8-17. Stream classification and distribution of game fish and selected nongame fish by hydrologic subunit in the Nevada/Utah study area[1] (Page 2 of 5).

Hydrologic Subunit Stream	Length (mi)	Value Class[2]	Dominant Species	Stocked
Seitz Creek	18	3-I	Brook Trout	
Smith Creek	22	2-I, 3-I	Brook, Lahontan Cutthroat Trout	
Ten Mile Creek	18	3-III	Brook Trout	
Toyn Creek	7	3-II	Brook, Lahontan Cutthroat Trout	
Willow Creek	12	3-II	Brook Trout	
Pine Valley, Nev. (#53)				
Humboldt River	42	3-II	Channel Catfish, Black Bullhead, Largemouth Bass, Smallmouth Bass, Bluegill Sunfish	
Carico Lake Valley (#55)				
Hall Creek	7.5	3-IV	Rainbow Trout	Rainbow
Iowa Canyon Creek	8.5	2-III	Lahontan Cutthroat Trout	Rainbow
Upper Reese River Valley (#56)				
Boone Creek	9	3-II	Brook Trout	
Clear Creek	2	III	Brook, Rainbow Trout	
Cottonwood Creek	1.2	III	Brook Trout	
Crane Creek	0.5	II	Lahontan Cutthroat Trout	
Crippen Creek	1-	3-II	Rainbow Trout	
Crum Canyon Creek	8	3-I	Brook Trout	
Elder Creek	8		Yellowstone Cutthroat, Rainbow Trout	
Illinois Creek	3.5	III	Brook Trout	
Italian Creek	10	2-II	Lahontan Cutthroat Trout	
Marysville Creek	8	III	Brook, Rainbow, Trout	
Mohawk Creek	3.5	IV	Brook, Rainbow, Brown, Lahontan Cutthroat Trout	
Reese River	15	3-II	Brook, Rainbow, Brown Trout	
Silver Creek	4.1	3-III	Brook, Rainbow, Brown, Lahontan Cutthroat Trout	
Stewart Creek	8.5	II	Brook, Rainbow, Brown, Lahontan Cutthroat Trout	
Tierney Creek	8	I	Brook, Lahontan Cutthroat Trout	
Washington Creek	9	2-I	Lahontan Cutthroat Trout	
Lower Reese River Valley, Nev. (#59)				
Humboldt River	12	III	Channel Catfish, Smallmouth Bass	
Len's Creek	8	3-I	Brook Trout	Brook
Mill Creek	18	3-I	Brook, Rainbow Trout	Rainbow
Trout Creek (a)	10	3-I	Brook Trout	Brook
Trout Creek (b)	12	3-II	Brook Trout	
Smith Creek Valley, Nev. (#134)				
Campbell Creek	8.3	3-III	Brook Trout	
Peterson Creek	6.9	3-IV	Brook, Rainbow Trout	
Smith Creek	9	3-II	Brook, Rainbow, Brown Trout	
Big Smoky Valley (North), Nev. (#137B)				
Big Creek	7	3-II	Brook, Rainbow, Brown Trout	Rainbow
Birch Creek	10	3-I	Brook, Rainbow, Brown Trout	
Bowan Creek	7.7	3-II	Brook, Rainbow Trout	
Carseley Creek	5	3-II	Brook, Rainbow Trout	
Franchmen Creek	0.3	3-IV	Brook Trout	
Kingston Creek	9.2	3-I	Lahontan Cutthroat, Brook, Rainbow, Brown Trout	Rainbow
Santa Fe Creek	5.4	2-I	Lahontan Cutthroat Trout	
Sawmill Creek	1	3-II	Brook Trout	
Shoshone Creek	2.5	2-I	Lahontan Cutthroat Trout	
Belcher Creek	0.4	III	Brook, Rainbow Trout	
Broad Creek	0.9	III	Brook, Rainbow Trout	Rainbow

Table 3.2.3.8-17. Stream classification and distribution of game fish and selected nongame fish by hydrologic subunit in the Nevada/Utah study area[1] (Page 3 of 5).

Hydrologic Subunit Stream	Length (mi)	Value Class[2]	Dominant Species	Stocked
Jefferson Creek	5	IV	Brook, Rainbow, Brown Trout	Occasionally
Jett Creek	1.2	III	Brook, Rainbow, Brown Trout	Rainbow
Last Chance Creek	5.3	II	Rainbow Trout	
Moores Creek	8.9	II	Lahontan Cutthroat, Brook, Rainbow, Brown Trout	Rainbow
North Town River	7	II	Brown, Rainbow Trout	
Ophir Creek	6.6	II	Lahontan Cutthroat, Brook, Brown Trout	Rainbow
Pablo Creek	2	IV	Brook, Rainbow, Brown Trout	
Peavine Creek	6.4	II	Yellowstone Cutthroat, Brown, Rainbow, Brook Trout	Rainbow
South Twin River	7	II	Brook, Rainbow Trout	
Summit Creek	2.3	III	Brook, Rainbow Trout	
Willow Creek	0.3	IV	Brook, Rainbow Trout	
Wisconsin Creek	4.5	III	Brook, Rainbow Trout	
Grass Valley, Nev. (#138)				
Callahan Creek	3.5	3-II	Brook, Rainbow, Trout	
Cowboy Rest Creek	6	3-IV	Rainbow Trout	
Skull Creek	8.1	3-I	Brook, Rainbow, Brown Trout	
Steiner Creek	4.5	3-III	Brook Trout	
Kobeh Valley, Nev. (#139)				
Roberts Creek	8.5	3-I	Brook, Rainbow, Brown Trout	
Monitor Valley, Nev. (#140)				
Coils Creek	4.0		Rainbow Trout	
Denay Creek	3.1		Brook, Rainbow Trout	
Andrews Creek	5.7	II	Lahontan Cutthroat Trout	Cutthroat
Carley Creek	6	II	Brook, Rainbow, Brown Trout	Rainbow
Corcoran Creek	3.3	II	Rainbow, Brown Trout	
Cottonwood Creek	7.7	II	Brook, Rainbow, Brown Trout	
Meadow Canyon Creek	7.8	IV	Brook, Rainbow Trout	
Morgan Creek	4.5	IV	No fishes	
Mosquito Creek	6.4	II	Brook, Rainbow, Lahontan Cutthroat Trout	Rainbow
Pine Creek	6.4	II	Lahontan Cutthroat, Brook, Rainbow, Brown Trout	
Stoneberger Creek	7.1	III	Brook, Rainbow, Brown Trout	
Ralston Valley, Nev. (#141)				
Hunt's Canyon Creek	2.5	III	Brown, Brook Trout	
Stone Cabin Valley, Nev. (#149)				
George's Canyon Creek	1.6	IV	Brook, Lahontan Cutthroat Trout	
Little Fish Creek Valley, Nev. (#150)				
Clear Creek	4.2	III	Brook, Rainbow Trout	
Danville Creek	2	III	Brook, Rainbow Trout	
Green Monster Creek	2.7	IV	Rainbow Trout	Rainbow
Sawmill Creek	3	III	Brook Trout	
Antelope Valley, Nev. (#151)				
Allison Creek	4.5		Brook Trout	
Newark Valley, Nev. (#154)				
Hunter Creek	5.9		Brook, Rainbow Trout	
Pinto Creek	2	IV	Rainbow Trout	
Hot Creek Valley, Nev. (#156)				
Hot Creek	1.5	II	Moapa dace, Railroad Valley Springfish transplants, unnamed Tui Chub subspecies	
Six Mile Creek	3	III	Brook Trout	

Table 3.2.3.8-17. Stream classification and distribution of game fish and selected nongame fish by hydrologic subunit in the Nevada/Utah study area[1] (Page 4 of 5).

Hydrologic Subunit Stream	Length (mi)	Value Class[2]	Dominant Species	Stocked
Green Valley, Nev. (#172)				
Cherry Creek	2.8	III	Rainbow Trout	
Cottonwood Creek	2	II	Brook Trout	
Pete Hansen Creek	4.4		Brook, Rainbow Trout	
Varini Creek	6.0		Rainbow Trout	
Railroad Valley North, Nev. (#173B)				
Duckwater Creek			Unnamed Tui Chub	
Current Creek	16.1	II	Brook, Rainbow Trout	
Deep Creek	0.6	III	Rainbow Trout	
Hooper Canyon Creek	1.8	III	Brook, Rainbow Trout	
Pine Creek	2	III	Brook Trout	
Tory Canyon Creek	5.3	III	Brook Trout	
Willow Creek	0.3	IV	Rainbow Trout	
Jakes Valley, Nev. (#174)				
Illipah Creek	7.4	3-I	Brook, Rainbow, Brown Trout	
Ruby Valley, Nev. (#176)				
Battle Creek	5.0	3-II	Brook, Golden Trout	
Carter Creek	3.0	3-II	Brook Trout	
Cave Creek	0.3	3-II	Brook Trout	
Dawley Creek	3.0	3-II	Brook Trout	
Griswold Creek	2.0	3-II	Golden Trout	Golden in 1963
Lutts Creek	5	3-III	Brook Trout	
Mayhew Creek	3	3-II	Brook Trout	
Myers Creek	3	3-III	Brook Trout	
Overland Creek	6	3-I	Brook Trout	
Robinson Creek	6	3-II	Brook Trout	
Smithers Creek	7	3-I	Golden Trout	
Thompson Creek	4	3-III	Brook Trout	
Thorpe Creek	12	2-I, 3-II	Brook, Lahontan Cutthroat Trout	
Withington Creek	2.5	3-II	Brook Trout	
Wines Creek	3.5	3-II	Brook Trout	
Clover Valley, Nev. (#177)				
Gordon Creek	4.5	3-II	Rainbow Trout	
Greys Creek	3.5	3-II	Brook Trout	
Herder Creek	3.5	3-II	Brook Trout	
Horse Creek	3.5	3-II	Brook Trout	
Johnson Creek	3.5	3-II	Brook Trout	
Leach Creek	4.3	3-II	Brook Trout	
Schoer Creek	5.0	3-I	Brook Trout	
Steele Creek	4.0	3-I	Brook Trout	
Weeks Creek	4.5	3-I	Brook Trout	
Butte Valley, Nev. (#178)				
Odgers Creek			Relict Dace	
Spring Creek			Relict Dace	
Paris Creek	3.4	3-II	Brook Trout	
Taylor Creek	7	3-II	Rainbow Trout	
Steptoe Valley, Nev. (#179)				
Berry Creek	2.0	3-II	Rainbow, Brown Trout	
Lower Berry Creek	2.1	3-II	Rainbow, Brown Trout	Rainbow
Bird Creek	0.8	3-II	Brook, Rainbow Trout	Rainbow
Cave Creek	1.9	3-I	Brook, Rainbow, Brown Trout	

Table 3.2.3.8-17. Stream classification and distribution of game fish and selected nongame fish by hydrologic subunit in the Nevada/Utah study area[1] (Page 5 of 5).

Hydrologic Subunit Stream	Length (mi)	Value Class[2]	Dominant Species	Stocked
Duck Creek	10.5	3-I	Brook, Rainbow, Brown Trout	Rainbow
East Creek	2.9	3-II	Brook, Rainbow, Brown Trout	Rainbow
Egan Creek	2.8	3-III	Rainbow Trout	
Goshute Creek	7.0	2-I	Bonneville Cutthroat Trout	
Big Indian Creek	6.0	3-II	Brook, Rainbow Trout	
Mattier Creek	4.0	3-II	Brook, Rainbow Trout	
McDermitt Creek	12.0	3-II	Brook, Rainbow Trout	
Nelson Creek	7.0	2-I	Cutthroat Trout	
Steptoe Creek	20.0	3-I	Brook, Brown Trout	
Tailings Creek	7.3	3-III	Brook, Rainbow, Brown Trout	Rainbow
Timber Creek	1.5	3-II	Brook, Rainbow Trout	Rainbow
Vipont (Stephena) Creek	4.0	3-II	Brook Trout	
Willow Creek	1.4	3-II	Rainbow, Brown Trout	
Spring Valley, Nev. (#184)				
Spring Valley Creek			Relict Dace	
Bastian Creek	2.8		Rainbow Trout	
Big Nigger Creek	11	3-II	Brook, Cutthroat, Rainbow, Brown Trout	
Clive Creek	19.4	3-I	Rainbow, Brown Trout	
Eight Mile Creek	3.5	3-IV	Rainbow Trout	
Kalamazoo Creek	6.9	3-I	Brook, Rainbow, Brown Trout	
McCoy Creek	4.2	3-II	Bonneville Cutthroat, Rainbow Trout	
Meadow Creek	4.4	3-II	Brook, Bonneville Cutthroat Trout	
Muncy Creek	6.6	3-II	Brook, Bonneville Cutthroat, Rainbow Trout	
North Creek	3.3	3-I	Brook, Bonneville Cutthroat, Rainbow Trout	
Odgers Creek	4.2	3-II	Bonneville Cutthroat, Rainbow Trout	
Piedmont Creek	6.7	3-I	Brook, Bonneville Cutthroat, Rainbow, Brown Trout	
Pine Creek	6	2-I	Bonneville Cutthroat Trout	
Siegel Creek	3.4	3-II	Brook Trout	
Sunkist Creek	1.3	3-II	Brook Trout	
Taft Creek	8.3	3-II	Brook, Rainbow Trout	
Willard Creek	3.5	2-I	Bonneville Cutthroat Trout	
Williams Creek	3	3-II	Rainbow Trout	
Meadow Valley, Nev. (#205)				
Meadow Valley Wash	45	IV	Bluehead Sucker, Meadow Valley Speckled Dace	
White River Valley, Nev. (#207)				
Forest Home Creek	2	III	Brown Trout	
Sunnyside Creek	6	II	Rainbow, Brown Trout	Rainbow, Brown
Water Canyon Creek	10.4	3-II	Rainbow Trout	
White River	19	3-II	Brook, Rainbow, Brown Trout	Rainbow

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[1] Blank spaces indicate data are unavailable.

[2] Value Class is defined on page 10 et seq.

Sources: Nevada Department of Wildlife, 1977; Wydoski and Berry, 1976; State of Utah, 1980.

Table 3.2.3.8-18. Nevada gamefish harvest (effort and success).

Year	Anglers	Days	Fish	Average	
				Days/Angler	Fish/Day
1976	227,688	1,374,484	3,363,595	6.03	2.44
1977	206,271	1,462,684	3,329,781	7.09	2.27
1978	178,684	1,657,295	3,752,800	9.28	2.26
1979	189,362	1,761,886	3,836,687	9.30	2.18

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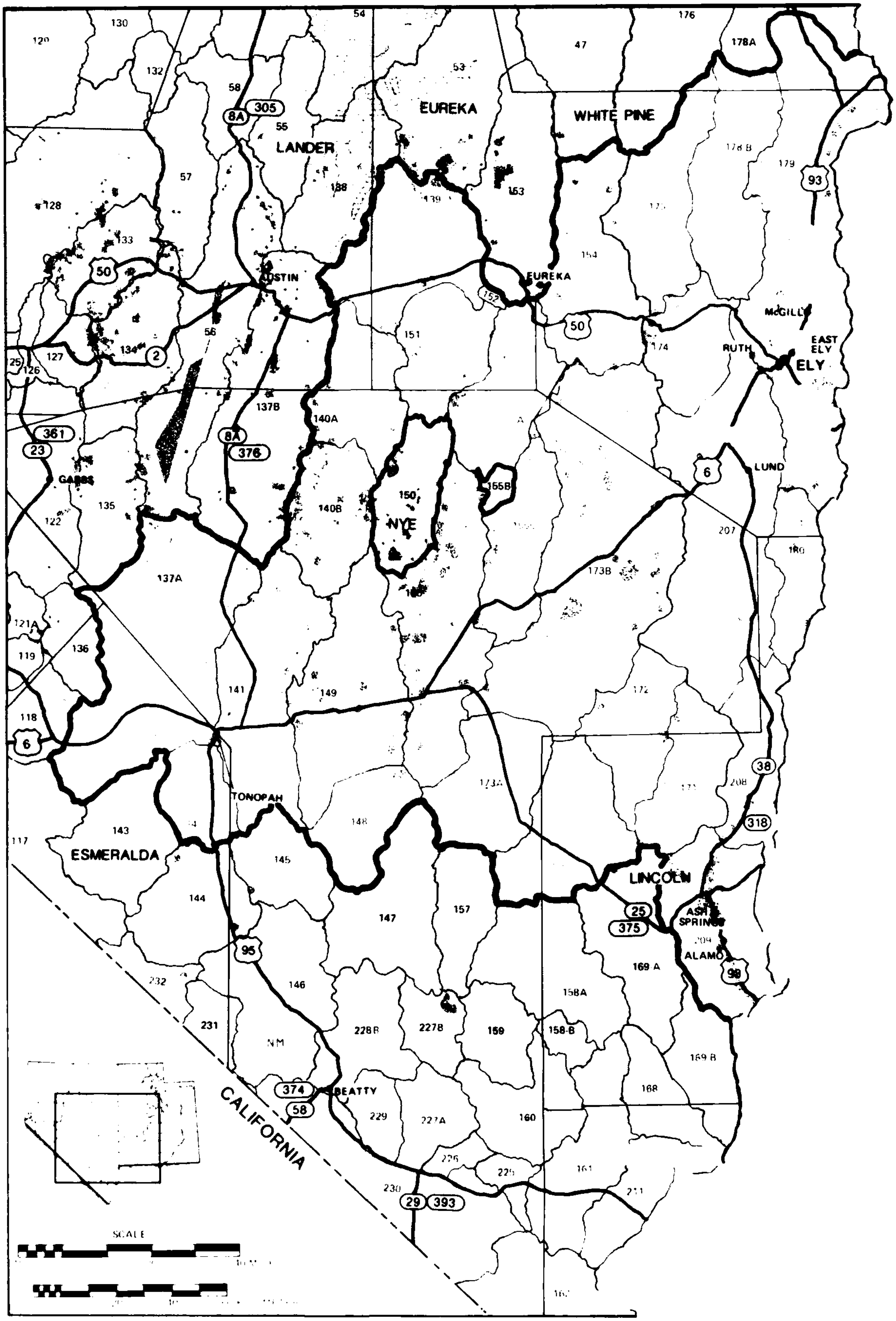
Source: Nevada Department of Wildlife, 1980.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EUREKA
WHITE PINE
NYE
ESMERALDA
LINCOLN
AUSTIN
EUREKA
ELY
EAST ELY
McGILL
RUTH
LUND
GABBS
TONOPAH
BEATTY
ASH SPRINGS
ALAMO
CALIFORNIA
SCALE

4459-D

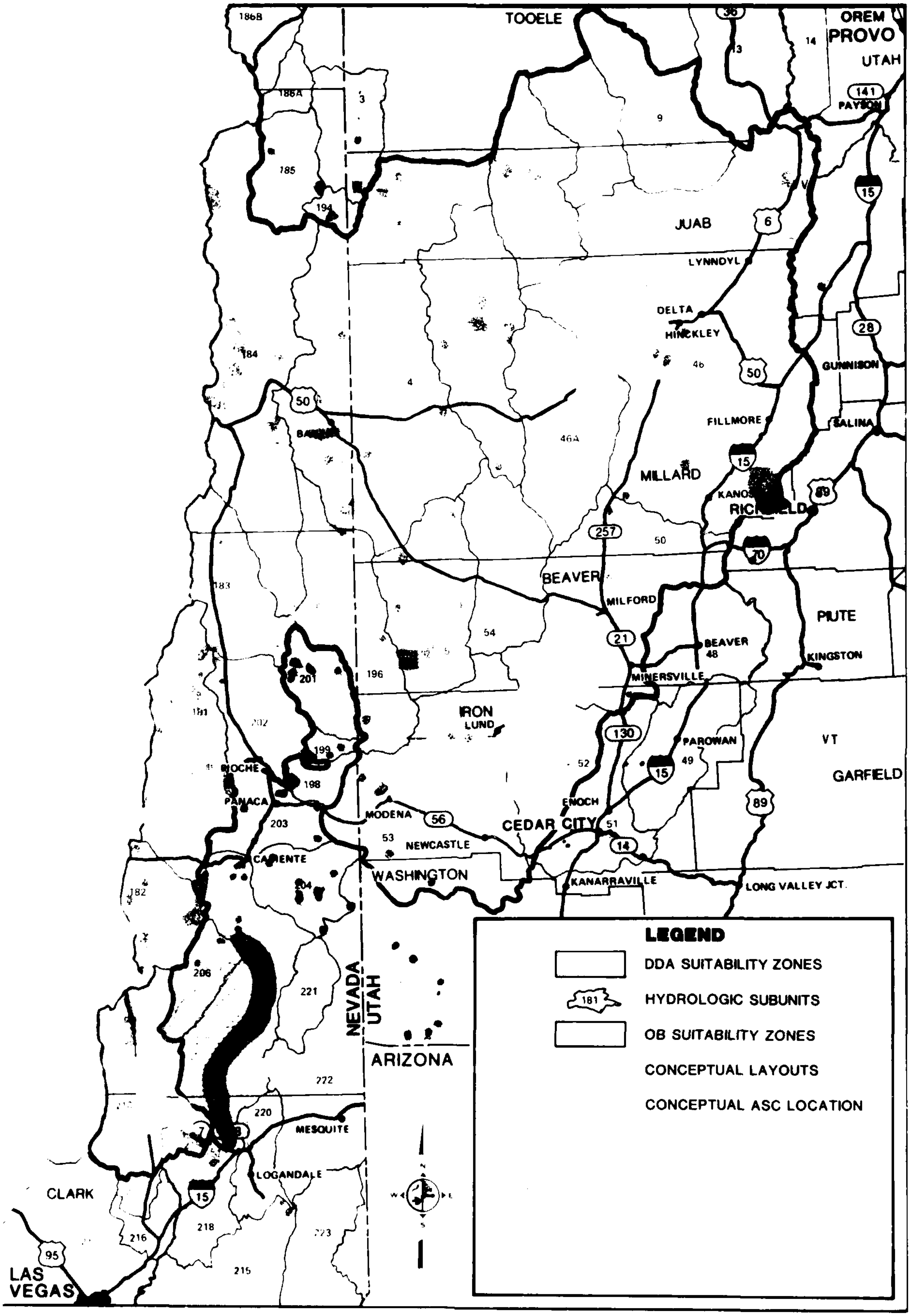

Figure 3.2.3.9-1. Native American cultural resources, known and predicted sensitive areas in the Nevada/Utah study area.

Table 3.2.3.9-1. Plants used by the Great Basin Indians (Page 1 of 8).

Genus	Species or Common Name	Usage
Abies	white fir	M *
Abronia	verbena, sand puff	M
Achillea	yarrow	M
Agastache	mint	M
Agropyron	bluejoint	E
Agrostis	red top	E
Allium	wild onion	E
Amalchoer	june berry	*
Amaranthus	pigweed	E
Amelanchier	service berry	M E *
Ambrosia	ragweed	M
Amsinkia	tessellata	E
Anemopsis	yerba mansa	M
Angelica	breweri	M
Aphyllon	cancer root	E
Aplopappus	golden weed	M
Apocynum	dogbane	*
Aquilegia	columbine	M
Arabis	rockcress	M
Arctostaphylos	green manzanita	M
Arenaria	aculeata	M
	congesta	M
	obtusa	M
Argemone	prickly poppy	M
Artemisia	sagebrush	M E *
Asclepias	milkweed	M
Asparagus	wild asparagus	E
Aster	frondosus	
	scopulorum	M
Astragalus	rattleweed	
	locoweed	M

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Table 3.2.3.9-1. Plants used by the Great Basin Indians (Page 2 of 8).

Genus	Species or Common Name	Usage
Atriplex	salt brush	M
Balsamorhiza	arrowroot	M
Battarrea	puff ball	M
Berberis	barberry Oregon grape	M E
Bigelovia	rabbit brush	E
Brassica	wild mustard	M
Brickellia	oblongifolia	M
Bromus	bromegrass	E
Byrum	moss	M
Calchortus	sego	E
Camassia	esculenta	E
Carex	utriculata	E
Carum	gairdneri	E
Casilleja	paintbrush	M
Catabrosa	aquatica	M
Caulanthus	crassicaulis	M
Cematis	legusticifolia	M
Cercocarpus	mountain mahogany	M *
Chaenactis	nevadensis	M
Chamaebataria	millefolium	M
Chenopodium	capitatum leptophyllyum rubrum	E E E
Chrysothamnus	rabbit brush	M
Cicuta	poison parsnip	M
Cinna	rood reed grass	E
Cirsium	thistle	E
Citrullus	vulgaris	E
Claytonia	miner's lettuce	M E
Clematis	virgin's bower	M
Cleome	integrifolia	M

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Table 3.2.3.9-1. Plants used by the Great Basin Indians (Page 3 of 8).

Genus	Species or Common Name	Usage
Clistoyucca	Joshua tree	E *
Cnicus	plumed thistle	M E
Collinsea	parviflora	M
Commandra	bastard toad flax	M
Corallorrhiza	coral root	M
Cordylanthus	ramosus	M
Cornus	dogwood	M
Cowania	cliffrose	M *
Crepis	hawksbeard	M
Cucurbita	desert gourd	M
Cuscuta	dodder	M
Cymopterus	globosus	M
	longipes	E
	montanus	E
Dalea	freemontii	M
	smokebrush	M
Datura	jimson weed	M
Deschampsia	caespitosa	E
Desmanthus	illinoensis	M
Dracocephalum	parviflorum	E
Dyssodia	thurberi	M
Echinocarpus	devil's pincushion	*
Elymus	rye grass	M
Enceliopsis	red brush	M
Epicampes	grass	*
Ephedra	nevadensis	
	viridis	M E
Equisetum	horsetail rush	*
Erigeron	fleabane	
	brass buttons	M
Eriodictyon	mountain balm	M

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Table 3.2.3.9-1. Plants used by the Great Basin Indians (Page 4 of 8).

Genus	Species or Common Name	Usage
Eriogonum	silver plant, butterballs	
	wild buckwheat	M
Eryngium	button snakewood	M
Euphorbia	spurge	M
Eurotia	whitesage, winterfat	M
Ferula	multifida	M E
Festuca	ovina	E
	tenella	
Forsellesia	nevadensis	M
Fragaria	strawberry	E
Frasera	albomarginata	M
Fritillaria	tiger or brown lily	M
Geranium	freemontii	M
Gilia	gracilis	M
Glyceria	distans	E
	hevata	
Grindelia	gumweed	M
Grossularia	gooseberry	E
Gutierrezia	snakeweed	M
Gymnolomia	multiflora	E
Hedeoma	pennyroyal	M
Hedysarum	mackenzii	M
Helianthellia	little sunflower	M
Helianthus	sunflower	M E
Heliotropium	heliotrope	M
Heracleum	cow parsnip	M
Hermidium	four o'clock	M
Heuchera	alum root	M
Holodiscus	rock spirea	M
Hypericum	St. John's wort	M

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Table 3.2.3.9-1. Plants used by the Great Basin Indians (Page 5 of 8).

Genus	Species or Common Name	Usage
Iris	wild iris	M
Iva	poverty weed	M
Juncus	--	*
Juniperus	juniper	M E *
Koeleria	cristata	E
Krameria	grayi	M
Krynitzkia	sericea	M
Larrea	creosote bush	M
Lathyrus	ornatus	E
Lepipium	peppergrass	E
Leptotaenia	coughroot, Indian balsam	M
Linum	wild flax	M
Lithospermum	stickseed	E
Lomatium	wild carrot	E
Lophanthus	urticifolius	E
Lophaphera	peyote	M
Lupinus	lupine	M
Lygodesmia	skeleton weed	M
Malvastrum	false mallow	*
Mammillaria	cactus	E
Marrubium	horehound	M
Matricaria	may apple	M
Martynia	devil's claw	*
Mentha	wild common mint	M
Mentzelia	laevicaulis	M
Mimulus	monkey flower	M
Mitella	trifida	M
Monardella	western balm	M
Nasturtium	watercress	E
Nicotiana	wild tobacco	M
Oenothera	evening primrose	M E

Table 3.2.3.9-1. Plants used by the Great Basin Indians (Page 6 of 8).

Genus	Species or Common Name	Usage
Opuntia	beavertail cactus prickly pear	M E M E
Orobanche	broomrape	M E
Orogenia	Indian potato	E
Osmorhiza	sweetroot	M
Paeonia	wild peony	M
Parnassia	fimbriata	M
Parrya	daggerpod	M
Pedicularis	elephant head	M
Penstemon	red penstemon	M
Peucedanum	graveolens	M
Phragmites	reed or cane	E *
Picea	Engelmann spruce	*
Pinus	pinyon	E *
Plantago	common plantain	M
Pluchea	arroweed	M
Populus	quaking aspen black cottonwood	 M *
Porophyllum	leucospermum	M
Prosopsis	screwbean	M E
Prunus	andersonii demissa	 M E
Psathyrotes	turtleback	M
Pseudotsuga	Douglas fir	*
Purshia	antelope brush	M
Pyrola	shinleaf	
Ranuculus	buttercup	E
Rhus	squaw bush, sumac	M E *
Ribes	black currant golden currant	 M E *
Rosa	wild rose	M E

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Table 3.2.3.9-1. Plants used by the Great Basin Indians (Page 7 of 8).

Genus	Species or Common Name	Usage
Rubus	raspberry	M E
Rumex	sanddock wild rhubarb	M E
Salix	willow	M *
Scutellaria	skullcap	E
Sencio	chewing gum	E
Shepherdia	buffalo berry	*
Silene	multicaulis	M
Sisymbrium	hedge mustard	M E
Sitanium	hystrix	E
Smilacina	false solomonseal	M
Solanum	nightshade	M
Sphaeralcea	desert mallow	M *
Sphenosciadium	yellow prince's plume	M
Spiroea	millefolium coespitosa	M
Stachys	woundwort	E
Stanleya	squaw cabbage	E
Strombocarpa	screwbean	E
Suada	seepweed	M E
Symphoricarpos	snowberry	*
Salvia	columbine purple sage	M E
Sambucus	elder	M E *
Sarcobatus	greasewood	M *
Sarcodes	snowplant	M
Scirpus	tule	*
Tanacetum	tansy	M
Taraxacum	dandelion	E
Tetradymia	comosa	M
Thalictrum	meadowrue	M

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Table 3.2.3.9-1. Plants used by the Great Basin Indians (Page 8 of 8).

Genus	Species or Common Name	Usage
Thamnosma	desert rue	M
Triglochin	maritimum	E
Trisetum	subspicatum	E
Troximon	auranticatum	E
Typha	cattail	M E
Urtica	nettle	M
Vaccinium	blueberry	M E
Valeriana	edulis	M E
Veratrum	false hellebore	M
Viola	wild pansy	M
Welwitschia	diffusa	M
Wyethia	amplexicaulis mollis	M
Yucca		*
Zigadenus	foothill death camas	M

T5291/9-29-81

M = medicinal
E = edible
* = manufacturing

Sources: Chamberlin, 1909, 1911; Evler, 1966; Facilitators, 1980; Intertribal Council of Nevada, 1976; Kelly, 1964; Kirk, 1975; Malouf, 1974; Moore, 1978; Steward, 1938; Train, Heinrichs & Archer, 1974.

Table 3.2.3.9-2. Common fauna used by Great Basin Indians.

Animals

Antelope (Pronghorn)	Coyote	Rabbits
Badger	Dogs	blacktail
Bear	Elk	cottontail
Beaver	Fox	jack rabbit
Bighorn Sheep	Gophers	pigmy rabbit
or Mountain Sheep	Ground squirrel	whitetail
Bison	Lizards	Rats
Bobcat	Marmot, rockchuck	Snakes
Chipmunk	Mink	rattlesnake
Chuckwalla	Mountain lion	Tortoise
	Mule deer	Weasel
	Porcupine	Whitetail deer

Birds

Blackbird	Eagles	Quail
Chukar partridge	Geese	Sage grouse
Dove	Magpie	Swans
Duck	Mud hen	Wild turkeys

Fish

Bass	Suckers	Trout
Carp	flannel mouth	Bonneville
Chub	humpback	brook
Mullet	mountain	german brown
Salmon	razorback	mountain
	white	yellow fin

Insects

Ants	Caterpillars	Fly larvae
Black cricket	Cicada	Grasshoppers
Carpenter bee		

5150/9-18-81

Sources: Chamberlin, 1911; Euler, 1966; Facilitators, 1980; Intertribal Council of Nevada, 1976; Steward, 1938.

nuts are the most important plant resource. Pinyon groves are distributed commonly in the mountain areas, as illustrated in Figure 3.2.3.9-2.

Native plants are used for medicinal purposes. Willow, juncus, devil's claw, and other riparian species are used for basket-making. Special clays for pottery, decorative paints and glazes, and tempering materials such as mica and quartzite are also gathered (see ETR-21).

For hunting and gathering activities, Native Americans most often return to those areas utilized by their ancestors. Therefore, many currently used sites are located far from existing colonies and reservations.

Native American Land/Water Resources (3.2.3.9.2)

Nevada/Utah

Native American reservations are held in trust or restricted status by the federal government. Though Indian tribes have a legal identity different from that of the states (in many respects similar to a sovereign nation), they remain under the plenary power of the Congress.

There are over 2.5 million acres of Shoshone, Paiute, Washoe, and Ute Indian reservation lands in Nevada and Utah. Over 480,000 acres are within or adjacent to the study area. The reservations and colonies, their associated populations, and acreages are listed in Table 3.2.3.9-3 and shown in Figure 3.2.3.9-3.

The Paiute Indian Tribe of Utah is authorized to select a total of 15,000 acres of land located in Beaver, Iron, Millard, Sevier or Washington counties, Utah. The Tribe has until April 1982 to make locational determinations.

The Duckwater Shoshone propose to withdraw 352,000 acres of land which corresponds to the acreage for which BLM grazing permits are held by the Duckwater Indians and shared with other ranchers. This land is located in the Little Smoky north, central and south and Railroad-northern hydrologic units. The action is pending. In addition, the Te Moak Shoshone claim title to approximately 18 million acres in Nevada and Utah. The Ruby Valley treaty of 1863 described Western Shoshone lands. Treaty boundaries coincide with the Shoshone ancestral occupational areas. In 1951, the Indians brought an action before the Indian Claims Commission claiming damages for the deprivation of their former tribal lands (see ETR-21 for further detail on the Western Shoshone land claim).

In addition to these lands, the Yomba, South Fork and Duckwater Indians hold BLM permits for over 600,000 acres of grazing lands (Figure 3.2.3.9-4).

Federal water rights law generally states that water rights were reserved for Indians on reservations when the reservation lands were set aside. Many sources of on- and off-reservations water exist throughout the study area (see ETR-21 for further discussion of water rights).

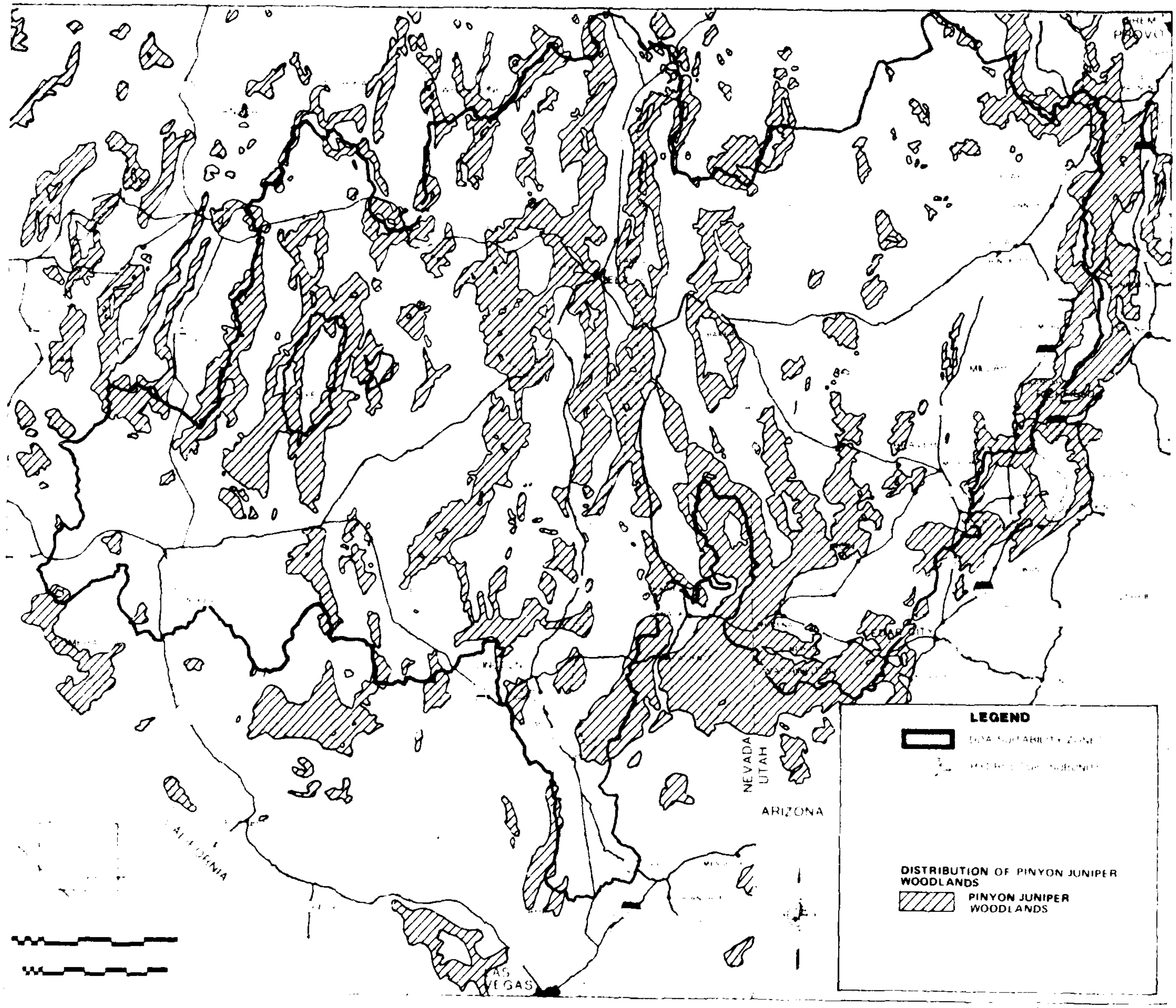

Figure 3.2.3.9-2. Pinyon-juniper woodlands in Nevada/Utah.

Table 3.2.3.9-3. Vital statistics of Native American reservations and colonies in the Nevada/Utah study area and vicinity.

Reservation Tribal Headquarters	County, State	Tribal Group	Enrolled Population Estimate	Acreage[1]	BIA Agency
Battle Mountain Colony, Battle Mountain	Lander, Nev.	Shoshone	175	683	E. Nevada
Cedar City, Cedar City	Iron, Utah	S. Paiute	138	5	Phoenix
Duckwater, Duckwater	Nye, Nev.	Shoshone	268	3,785[2]	E. Nevada
Elko, Elko	Elko, Nev.	Shoshone	395	193	E. Nevada
Ely, Ely	White Pine, Nev.	Shoshone	187	103[3]	E. Nevada
Fallon and Fallon Colony, Fallon	Churchill, Nev.	Shoshone, N. Paiute	669	8,250	W. Nevada
Goshute, Ibapah	White Pine, Nev.; Juab, Utah	Goshute	602	108,779	E. Nevada
Indian Peak, Cedar City	Beaver, Utah	S. Paiute	30	0	Phoenix
Kanosh, Cedar City	Millard, Utah	S. Paiute	80	80	Phoenix
Las Vegas Colony, Las Vegas	Clark, Nev.	S. Paiute	191	10	W. Nevada
Lovelock Colony, Lovelock	Pershing, Nev.	N. Paiute	346	20	W. Nevada
Moapa River, Moapa	Clark, Nev.	S. Paiute	208	72,000	W. Nevada
Odger's Ranch,[5]	Elko, Nev.	Shoshone	7	1,987[4]	E. Nevada
Richfield, Cedar City.	Sevier, Utah	S. Paiute	85	1.5	Phoenix
Ruby Valley,	Elko, Nev.	Shoshone	40	120	E. Nevada
Shivwits, Cedar City	Washington, Utah	S. Paiute	189	28,160	Phoenix
Skull Valley, Fort Duchesne	Tooele, Utah	Goshute	90	17,444	Uintah and Ouray
South Fork, Elko	Elko, Nev.	Shoshone	98	13,050	E. Nevada
Walker River, Schurz	Churchill, Lyon, and Mineral, Nev.	N. Paiute	2,000	323,386	W. Nevada
Winnemucca Colony, Winnemucca	Humboldt, Nev.	N. Paiute, Shoshone	225	340	W. Nevada
Yomba, Austin	Lander, Nev.	Shoshone	350	4,718[6]	W. Nevada

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[1] Acreage rounded to the nearest whole number.

[2] Duckwater also holds up to 800,000 acres in BLM permits.

[3] Ely leases 10 acres from the county.

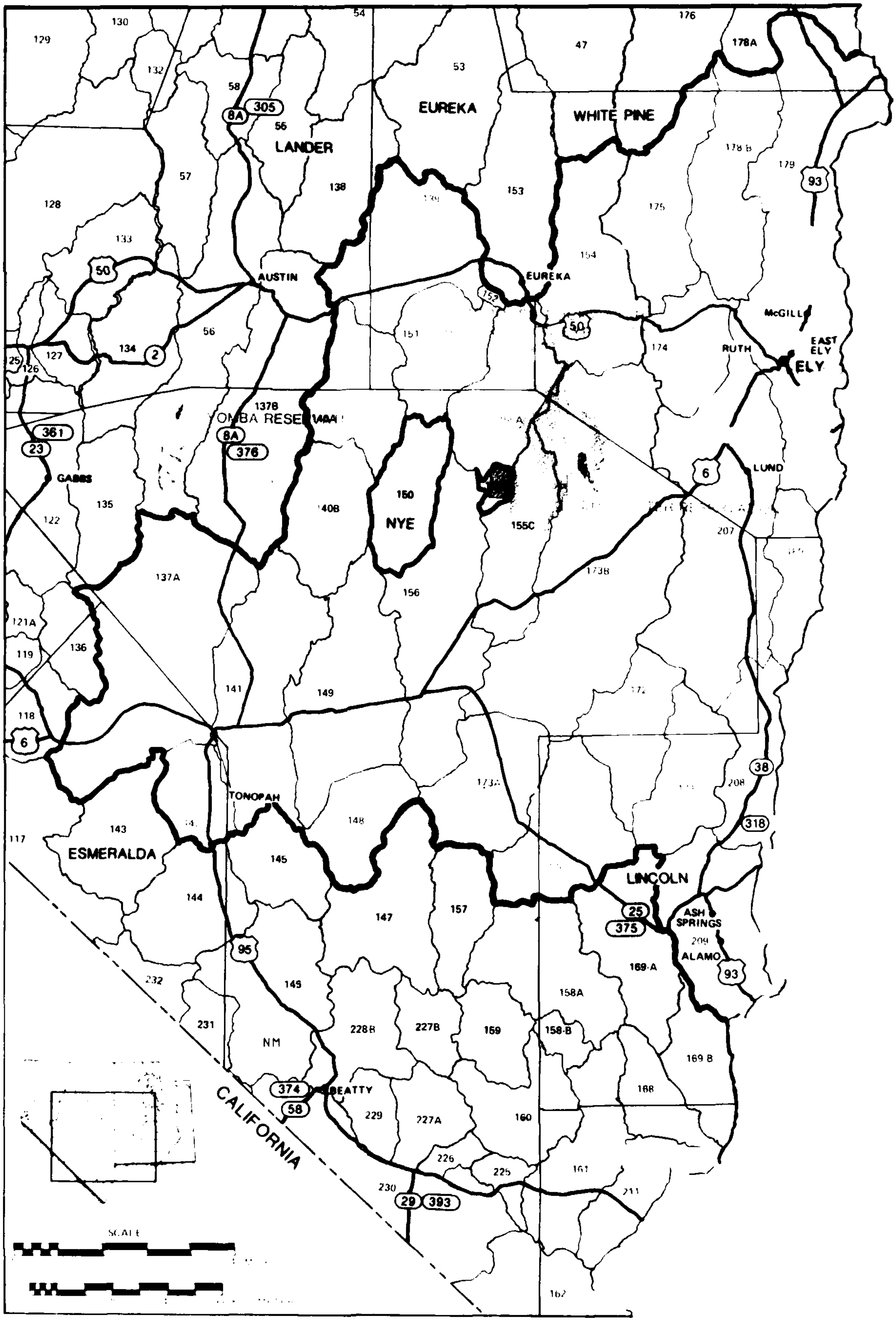
[4] Odger's Ranch also holds 40,000 acres in BLM permits.

[5] Combined population of South Fork, Ruby Valley, and Odger's Ranch is 145; Odger's Ranch has only 7; Ruby Valley had 40 residents in 1972.

[6] Yomba Reservation also holds 268,397 acres in BLM permits.

Sources: Bureau of Indian Affairs, 1978; U.S. Department of Commerce, 1974; Facilitators, 1980.

Note: The Kanosh, Cedar City, Koosharem/Richfield Indian Peaks and Shivwits Reservation of the Southern Pacific Tribe of Utah have recently been reinstated to federal trusteeship; their land base and enrollment is still open, but the reservation will constitute an additional 15,000 acres.



EUREKA
WHITE PINE
LANDER
AUSTIN
EUREKA
McGILL
EAST ELY
RUTH
ELY
LUND
GABBS
NYE
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
ALAMO
BEATTY
CALIFORNIA
SCALE

4459-D

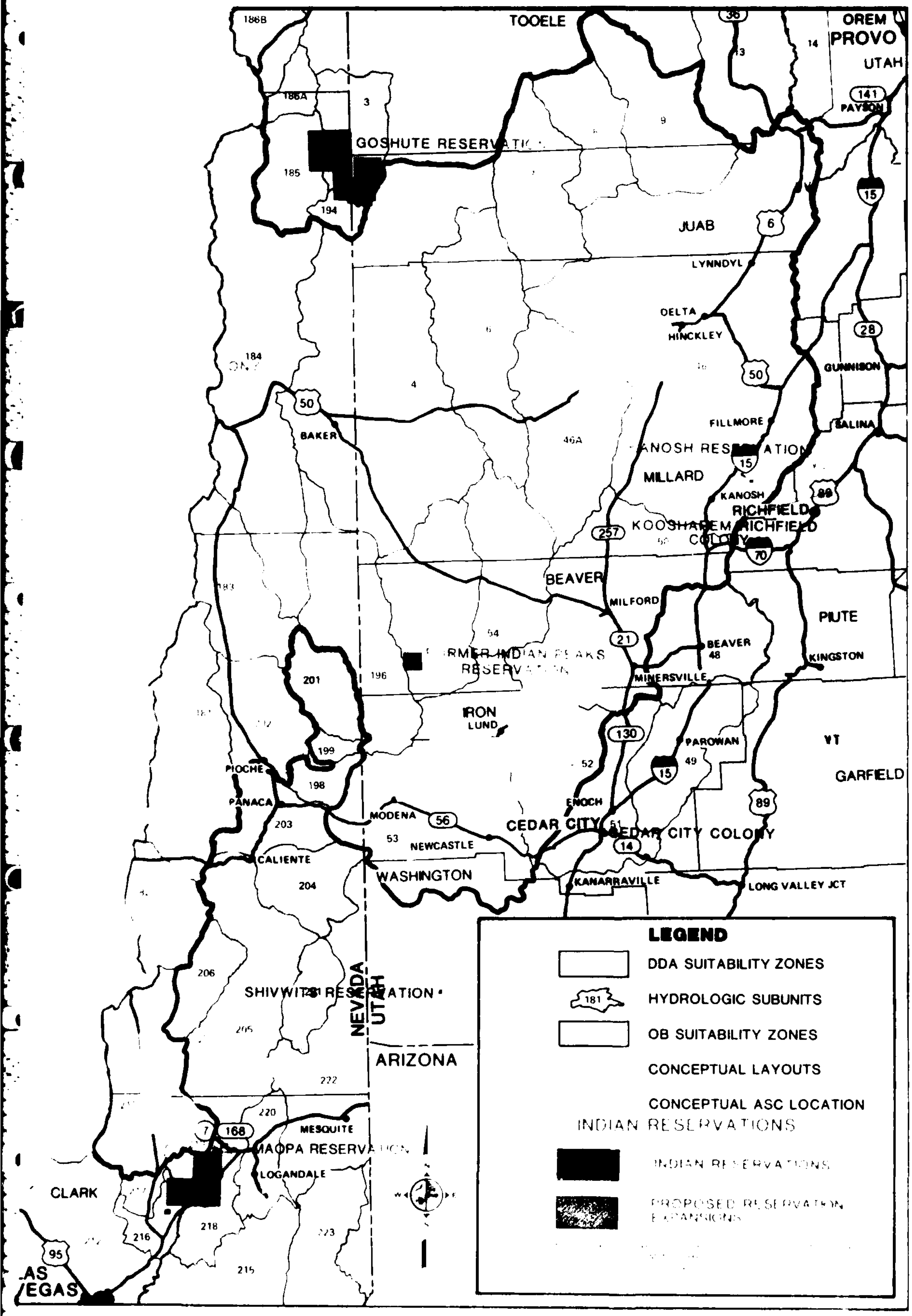


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Figure 3.2.3.9-3. Native American reservations, colonies, and proposed reservation expansions in the Nevada/Utah study area.

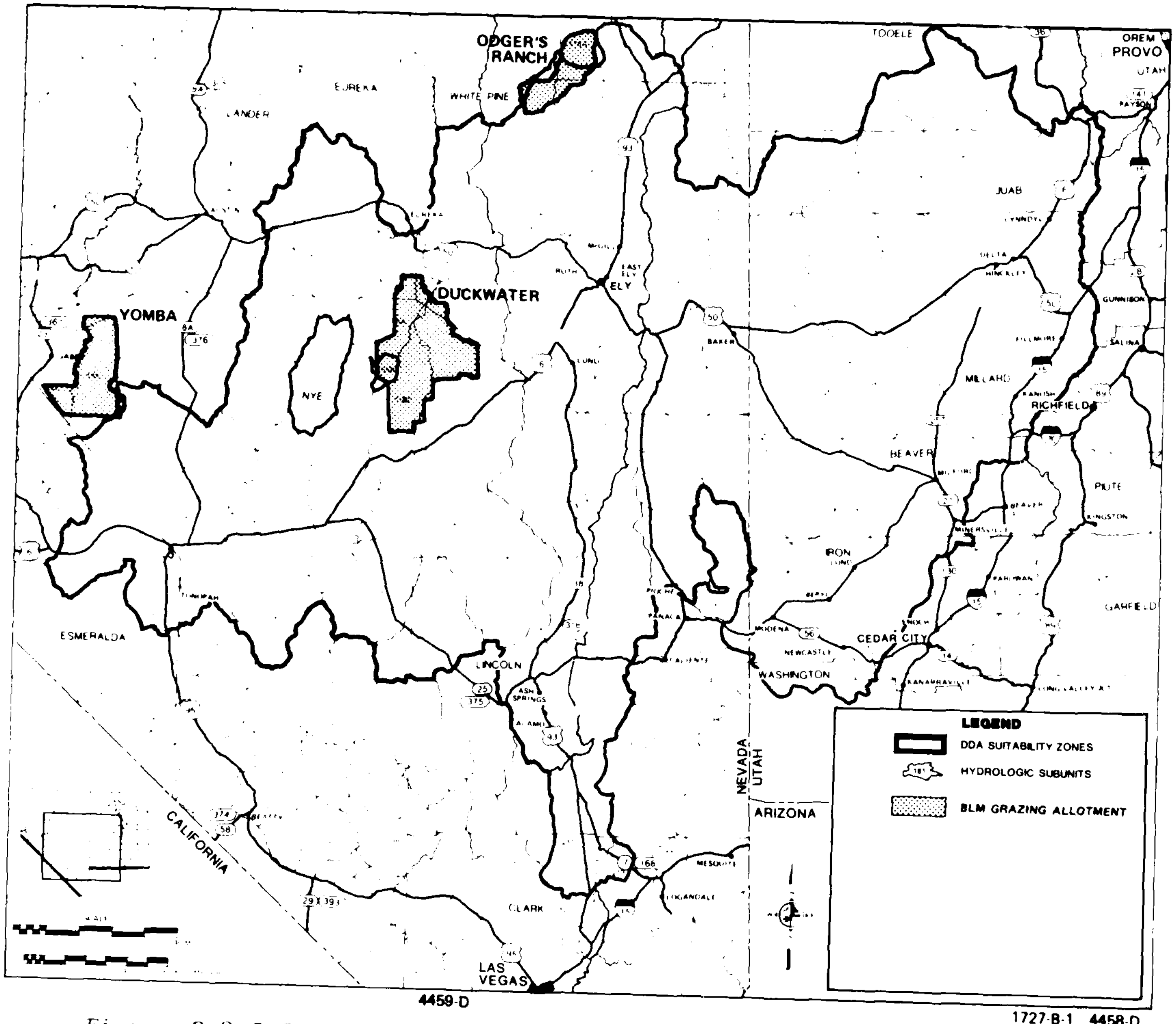

Figure 3.2.3.9-4. Native American BLM grazing allotments in the Nevada/Utah study area.

Water

The Humboldt River flows through or is adjacent to the Lovelock, Winnemucca, Battle Mountain, and Elko Indian colonies. The South Fork of the Humboldt and its tributaries are principal sources of water for the South Fork and Ruby Valley reservations. The Reese River, which flows into the Humboldt in the Battle Mountain area, is the principal source of water for the Yomba Reservation through which it flows. The Muddy River is an important water source for the Moapa Reservation and the Walker flows through the Walker Reservation. The Sevier River and its tributaries are important to the Southern Paiutes in Utah (Figure 3.2.3.9-5).

In addition to major rivers and tributaries, there are numerous springs of varying sizes in the study area that are economically significant for reservation and colony Native Americans. There are also thousands of small streams and creeks flowing out of the mountain ranges, many of which are important water resources for Native Americans.

Throughout most of the Great Basin, the stream and creek flows are erratic and/or minimal. Much of the surface water, therefore, is not diverted and used by man; rather it seeps into the ground. Wells are relied upon extensively by Indians and non-Indians for domestic, agricultural and other purposes and groundwater storage volumes are of central concern to the area inhabitants.

Native American Socioeconomic Characteristics (3.2.3.9.3)

Demographic Structure (3.2.3.9.3.1)

Population

Between 1970 and 1980, the population of the state of Nevada increased by 63.5 percent, the largest growth among all the states in the nation. The state of Utah increased in population by 37.9 percent, and the United States as a whole by 11 percent. Where growth in resident Native American populations has occurred over the last decade, it has been dramatic, varying from 33 percent (Ely Colony) to nearly 115 percent (Moapa Reservation). The exception is the population of the Las Vegas Colony, which has increased by only 3 percent. Also, several groups have experienced significant declines in population including: the Winnemucca Colony (-61 percent since 1970), the Battle Mountain Colony (-46 percent since 1973), and Skull Valley (-50 percent since 1970). (See Table 3.2.3.9-3 for reservation and colony populations.)

Key indicators of an economically disadvantaged status are the dependency factor (the ratio of young and old dependents to the working population, assumed here to be those between 24 and 64) and the ratio of males to females. The latter generally reflects the ability of females to find employment on or near the reservation. As with other economically disadvantaged populations, females are usually more readily assimilated by dominant groups into service sector jobs and can assume clerical/administrative positions in tribal and other government services. Table 3.2.3.9.3-1 summarizes available population distribution data for the resident tribal groups included in this study.

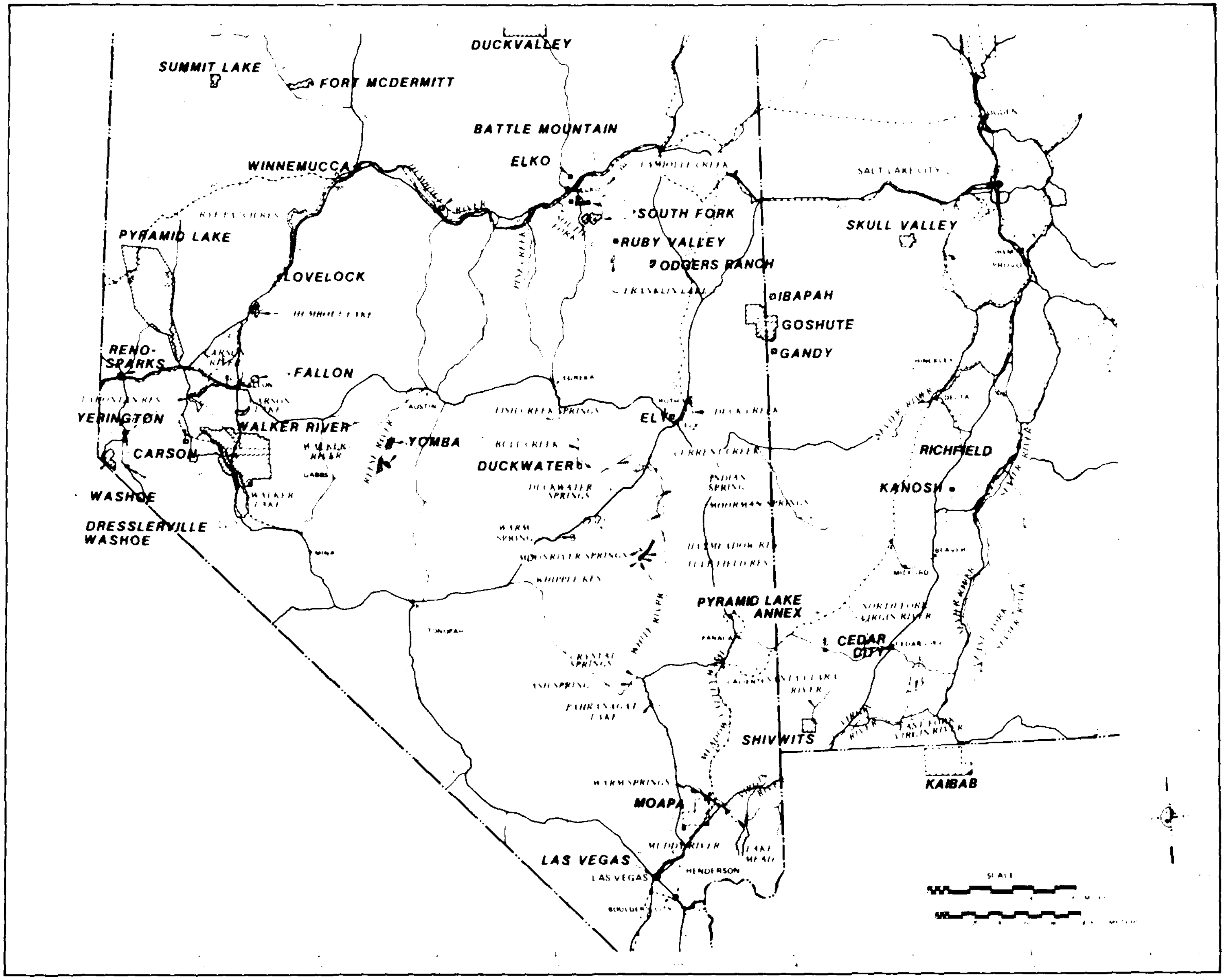

Figure 3.2.3.9-5. Important Native American water resources in the Nevada/Utah study area.

Table 3.2.3.9.3-1. Age distribution by percent of 1979 resident tribal populations in the M-X study area[1,2] (Page 1 of 2).

Tribal Group	0-24 Years			25-64 Years			65+			1979-80 Dependency Factor[3]
	M	F	T	M	F	T	M	F	T	
Northern Paiute Tribe										
Lovelock Colony	58	55	57	42	37	40	0	7	3	0.64
Fallon Reservation and Colony	53	49.6	51	40	40.6	41	5	9.8	8	--[8]
Walker River Reservation[4]	64	65	64	24	32	27	12.5	3.6	8	0.719
Winnemucca Colony	67	66	60	22	38	32	11	6	4	1.27
Western Shoshone Tribe										
Battle Mountain Colony	42.6	46.0	44.4	50.0	35.0	41.9	7.4	19.0	13.7	--[8]
Elko Colony	56	53	55	39	39	39.5	4	7	5.6	0.77
Ely Colony	51	58	55	43	36	39	6.5	5.7	6.0	--[8]
South Fork, Ruby Valley, and Odgers Ranch Reservations	45.4	59.3	53.0	38.6	25.9	31.6	15.9	14.8	15.3	0.5
Yomba Reservation	52.9	77.4	63.3	41.2	19.3	32.0	5.9	3.2	4.8	0.73
Duckwater Reservation[6]	33.8	43.0	38.5	52.3	51.4	51.8	13.8	5.7	9.6	--[8]
Goshute Reservation	58.5	70.5	64.7	34.2	27.7	28.2	7.3	6.8	7.06	1.02
Skull Valley Reservation	57.7	69.0	43.6	30.8	29.6	29.1	11.5	3.5	7.3	1.04
Southern Paiute Tribe in Utah										
Cedar City Colony	64.8	63.6	64.2	32.4	33.3	32.8	2.8	3.0	2.9	--[8]
Kanosh Reservation	66.7	60.5	63.6	30.8	26.3	28.6	2.6	5.3	3.9	--[8]
Richfield Colony[5]	56.0	51.7	52.9	36.0	31.7	32.9	* 8.0	16.7	14.1	0.97
Shivwits Reservation[5]	54.1	47.5	50.5	42.4	47.5	45.2	* 3.5	5.0	4.3	--[8]

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Table 3.2.3.9.3-1. Age distribution of 1979 resident tribal populations in the M-X study area[1,2] (Page 2 of 2).

Tribal Group	0-24 Years			25-64 Years			65+			1979-80 Dependency Factor[3]
	M	F	T	M	F	T	M	F	T	
Southern Paiute Tribe in Nevada										
Moapa Reservation	58.2	58.2	58.2	38.2	39.8	38.9	3.6	2.0	2.9	--[8]
Las Vegas Colony	not enough data									

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[1]Some data adjustments have been made to permit useful comparisons among different tribal groups and to account for conflicting data; (eg. U-24 and O-25 age charts were considered the same).

[2]Age group percentages are for all males, all females, and total both sexes in the tribal population.

[3]The U.S. dependency factor was 0.55 in 1975.

[4]Available age group data are for 0-29, 30-64, and 65+, resulting in somewhat higher percentages in the first group and lower percentages in the second for Walker River compared to trends indicated for other tribes.

[5]Available age group 0-24, 25-59, 60+.

[6]Available age group 0-18, 18-65, 65+.

[7]Data for South Fork only.

[8]Age groupings are such that dependency ratio cannot be determined.

Source: Facilitators 1980, Jamesan 1981.

A high dependency factor is characteristic of low-income groups and reflects several factors: the tendency for elders to return to a reservation during retirement, the custom of young parents, especially single mothers, to return to the reservation when infants are born, the practice of placing dependent children with relatives on the reservation, and the inability of rural economies to support their available labor force. Dependency ratios for the groups under study range from an unusual low of 0.5 (South Fork, Ruby Valley, and Odgers Ranch) to a high of 1.27 (Winnemucca Colony), with most of the groups clustered well above the U.S. ratio in 1975 of 0.55. In Native American communities, the out-migration of adults for economic reasons, combined with the shorter lifespan among Indians, typically results in a disproportionate number of young people. High dependency ratios also reflect economic and social values that encourage people to assist in the support of less fortunate others.

Important factors contributing to both population growth and dependency ratios among Native American resident populations are their considerably higher birth and (premature) death rates, which for 1975 averaged 22 and 13.3 per thousand, respectively, compared to the corresponding U.S. rates of 14.8 and 8.9 per thousand. These averages are based on available data for the groups studied with the exception of the group living in Clark County on the Moapa Reservation, which fell far outside the range of the others. For Clark County Native Americans, the 1979 birth rate was 46 per thousand, and the death rate was only 4.3 per thousand. The mortality rate resulting from complications of pregnancy, childbirth, and puerperium was 32.1 per 100,000 for Western Nevada Indian people within the Schurz Indian Health Service Unit, compared to the U.S. rate in 1975 of 0.2 per 100,000. The mortality rate in early infancy is also significantly higher: 34.2 versus 12.5 per 100,000.

A basic reason for such high mortality is the frequent incidence of "high risk" births: for example, those where the baby's weight is low (less than 2,500 grams or 5.6 pounds) or where the mother is younger than 17 years of age. Approximately 45.7 percent of all Indian births in the region are "high risk" compared to the non-Indian regional rate of 29.5 percent.

The leading causes of death among Native Americans in western Nevada are from accidents (twice the rate of the non-Indian population), heart disease, cirrhosis of the liver, cerebrovascular diseases, and suicide.

Household Composition

The number of extended family units indicates the tendency among Native Americans for several generations of a family to live together. This is a traditional social pattern and may suggest a parental preference for raising children in a community which subscribes to traditional values. It is also likely that this pattern is a response to the realities of depressed economic conditions and a lack of affordable housing. Table 3.2.3.9.3-2 summarizes the available data regarding family composition for the resevations and colonies within the study region.

Mobility

Migration and visitation patterns of Great Basin Native Americans reflect several features of reservation life: economic necessity, extreme distance from

Table 3.2.3.9.3-2. Family composition of 1979 resident tribal populations in the M-X study area.

Tribal Group	Total Households	Average Household Size	Independent Nuclear Family	Independent One-Parent Family	Extended Family	Couple Without Children	Sibling Household	Single Person Household
Northern Paiute Tribe								
Lovelock Colony	45	3.3	30	3	4	1	0	7
Fallon Reservation and Colony	125	3.9	89	7	13	6	4	6
Walker River Reservation	143	6.4	39	19	14	0	12	
Winnemucca Colony	12	2.08	4	6	0	2	0	0
Western Shoshone Tribe								
Battle Mountain Colony	32	3.7	NA	NA	NA	NA	NA	NA
Elko Colony	70	3.8	NA	NA	NA	NA	NA	NA
Ely Colony[1]	19	NA	10	6	0	1	0	2
South Fork Reservation	32	5.0	10	3	10	3	1	5
Yomba Reservation	NA	5.97	NA	NA	NA	NA	NA	NA
Duckwater Reservation	32	4.6	17	4	4	3	0	4
Goshute Reservation	NA	5.7	15	5	15	2	NA	20-30
Skull Valley Reservation	4	2.5-3.75	NA	NA	NA	NA	NA	NA
Southern Paiute Tribe in Utah								
Cedar City Colony	27	3.1	3	12	1	0	3	
Kanosh Reservation	NA	NA	NA	NA	NA	NA	NA	NA
Richfield Colony	16	5.1	5	4	5	2	0	0
Shivwits Reservation	27	NA	8	5	3	3	3	5
Southern Paiute Tribe in Nevada								
Moapa Reservation	46	4.5	20	6	16	0	0	4
Las Vegas Colony	25	3.8	0	0	19	0	0	6

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[1] On colony only.

health and educational facilities, the need for social exchange, and the desire to embrace one's cultural heritage. Among Great Basin Native Americans, current visitation patterns correspond to ancestoral migration to a large extent. Social and religious gatherings, pine nut festivals, powwows, hunting and gathering seasons, rodeos and other sporting events provide occasions for visits to relatives and friends. For instance, all-Indian basketball and softball teams travel throughout the western states, and all-Indian rodeos are popular events in most of rural America. For hunting and gathering purposes both Paiutes and Shoshones usually return to the same areas their ancestors used, following ancient paths which are generally distinct to each tribe.

These migration patterns have endured since white settlement began and are of critical importance to continuing the Indian peoples' way of life. Mobility for economic purpose and mobility for social purposes cannot easily be separated, and there is often no clear distinction between social, religious, and economic gatherings, since most events contain aspects of all of these.

Economic Structure (3.2.3.9.3.2)

The socioeconomic status of Native Americans in the study area is very low. Unemployment and underemployment are as high as 75 percent on some reservations. There is variation among the reservations in the Great Basin, but high levels of unemployment or short-term seasonal employment reduces per capita income averages to below $1,500 annually, compared to over $9,000 and $7,000 for Nevada and Utah, respectively (1979). A major contributing factor to this poverty is the inadequacy of reservation and colony land. Reservation lands are generally too small to provide an adequate economic base, and the productive potential of the land is low. There is no other economic infrastructure for most of these reservations (Moapa is a notable exception), and working members of rural tribes derive limited incomes from ranching operations and seasonal employment. (See Section 3.2.3.9.2 and Chapter 4 of ETR-21 for information on economic issues concerning land.)

Those living in colonies, where land use is largely residential, rely on nearby towns and cities for employment. Because of racial prejudice, low educational levels, and other factors, however, the unemployment rate for colony Native Americans is very high, and those who do work are generally relegated to low income, unskilled jobs.

Responses to precarious economic conditions are varied, but population mobility is one of the most apparent. Two themes are recurrent: (a) out-migration for employment and (b) subsistence hunting, gathering, and fishing to supplement the meager cash flow. Subsistence activities are discussed in the Land Use section of this EIS.

Out-migration for employment is a pervasive phenomenon among the tribes in the study area. Members of the labor force, especially young adults unable to find gainful employment on the reservation, leave. They are "pushed" from the reservation by economic pressure. "Push" factors include the inability to find a job, poor housing conditions, substandard sanitary and health conditions, and the overall lack of opportunity to improve the situation. In some cases, these "push" factors may be coupled with "pull" factors, an economic attraction which draws job seekers, such as mining or oil booms. Those who leave jobs to find employment away from

the reservation/colony may go alone, leaving their family behind, or, if they take their family along, may relocate to a town, city, or other reservation where other family members reside. The success rate for off-reservation permanent employment is low, however, and impoverished economic conditions prevail.

Community Infrastructure (3.2.3.9.3.3)

Tribal government and services

Tribal government is a pervasive element in reservation and colony life; it has a vital role in the provision of community and economic services as well as in politics. The tribal councils generally serve as economic development planning committees and administer housing, health services, education, and recreation programs. Other community services provided either directly by the tribal government or in conjunction with the Intertribal Council of Nevada (ITC) include Headstart programs, legal aid, alcoholism assistance, commodity food programs, career counseling, and senior citizens programs.

PUBLIC COMMENT ON THE DRAFT EIS:

"The tribal government also has a strong interest in divorce, child custody, inheritance and contracts involving tribal members and non-members. The rights of tribal governments to regulate persons and activities are absolute except where the federal government has preempted these powers." (A0989-3-002)

Tribal business offices are usually centrally located and in many cases are housed in new tribal administration complexes. The tribal government is usually the primary source of jobs on the reserve.

Tribal governments have made tremendous strides in establishing themselves as viable and independent political entities since the passage of the Indian Self-Determination Act (PL93638) in 1974. These governments are becoming increasingly vocal in their demands to be recognized as sovereign nations, a status which is legally accorded them by the federal government; their political influence is growing.

Tribal Jurisdiction

Governmental Powers

Recently there have been increased conflicts between tribal and state governments concerning persons and activities over which both assert an interest. These disputes have involved taxation powers, zoning regulations, fireworks, gambling, and liquor. The disputes over regulatory power are directly related to the decreasing isolation of reservations; the influx of non-members, especially non-Indians, onto tribal lands and surrounding areas; increased mobility of tribal members; and increased interaction between members and non-members. States have attempted to gain regulatory control where they perceive state interests are affected. State jurisdiction is foreclosed in areas where the federal government has

pre-empted the state and reserved the regulatory powers for itself. Warren Trading Post v. Arizona Tax Commission, supra. States have been excluded where tribal regulations have pre-empted the area. 54 Wash. L. Rev. 633 (1979). Additionally, the states cannot regulate areas where such regulation amounts to an infringement of tribal self-government. Williams v. Lee, 358 U.S. 217 (1959).

Civil Jurisdiction. The federal government has not involved itself in tribal civil jurisdiction to the extent of its involvement in criminal matters. Theoretically, state civil jurisdiction in only permitted where "essential tribal relations were not involved and where the rights of Indians would not be jeopardized". Williams v. Lee, 358 U.S. 217" (1959) (A0989-3-002)

Housing. Housing conditions have improved dramatically on most reserves in recent years due to increased HUD funding, but many homes remain substandard and overcrowding persists (see Table 3.2.3.9.3-3). Substandard in this context means in a deteriorated state. It is important to note that white, middle-class or even HUD standards in housing may not be appropriate to Native Americans who do not wish to assimilate white values. The outlook for further improvements in housing conditions in the near future appears bleak because of federal cutbacks in assistance programs.

Health Services. Health services and facilities for Native Americans in the study area are woefully deficient, as the high mortality and morbidity rates indicate. Primary health care problems on most reservations in the study area include high neonatal and infant mortality; alcoholism; poor dental, optometric, and geriatric care; and a lack of health education programs. Hospitals are located at some distance from most reservations; Indian Health Service teams make regular rounds to the reservations, but there are no contingency plans for emergencies. Even the IHS hospital at Schurz in Churchill County is extremely limited in its capacity to handle anything other than routine care.

Complicated medical cases, all deliveries, and surgical cases must be contracted to private physicians. Emergency care is virtually nonexistent for most reservations and colonies, and even at the Schurz Hospital there is often confusion about emergency procedures and requirements. Schurz must give prior approval for contract health care, and this may cause a delay before emergency care may be administered. The only non-Indians who can use Schurz services are non-Indian wives and children of Native Americans; non-Indian husbands are refused service.

Sanitation Services and Utilities. These vary by reservation. In general, colonies which are in or adjacent to towns, are serviced by municipal water, electricity, and telephone; garbage and waste disposal may be colony responsibilities. Rural reservations, on the other hand, tend to have utilities and no sewage or few sanitation disposal services. Septic tanks and drainage fields are the most common sewage disposal means and garbage is burned or hauled to a landfill.

Public and Safety Services. There is also considerable variation in public and safety services. Colonies have greater access to fire and police protection services, for example, than reservations. Rural reservations may be too far from fire protection for it to be much use, or the reservation may not have the water necessary to use fire fighting equipment. There has been little need for policing on most reservations to date; however, Bureau of Indian Affairs (BIA) police may be

Table 3.2.3.9.3-3. Indian owned or occupied homes and rental units[1] on reservations/colonies under study, 1979-80 (Page 1 of 2).

	Total Units	Occupancy Rate[4]	Substandard (Need Replacement) or Renovation	New Units Planned or Under Construction	Estimated Additional Housing Requirements
Northern Paiute Tribe					
Lovelock Colony	45	3.3	11	15	40
Fallon Reservation and Colony	141	4.0	45	49	20+
Walker River Reservation	138	6.0	49	24	64
Winnemucca Colony	9	2.7	9	8	-
Western Shoshone Tribe					
Battle Mountain Colony	32	3.7	12	27	-
Elko Colony	66[2]	3.1	NA	56	NA
Ely Colony	39	4.5	22	-	-
South Fork, Odgers Ranch, and Ruby Valley	40	2.9	16	-	10
Yomba Reservation	17	5.6	17	22	20
Duckwater Reservation	34	4.6	9	-	NA[3]
Goshute Reservation	35	5.7	-	-	-
Skull Valley Reservation	4-6	3.0	-	-	-

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Table 3.2.3.9.3-3. Indian owned or occupied homes and rental units[1] on reservations/colonies under study, 1979-80 (Page 2 of 2).

	Total Units	Occupancy Rate[4]	Substandard (Need Replacement) or Renovation	New Units Planned or Under Construction	Estimated Additional Housing Requirements
Southern Paiute Tribe in Utah					
Cedar City Colony	17	5.0	-	-	20
Kanosh Reservation	11	4.4	-	2	10
Richfield Colony	NA	NA	NA	NA	NA
Shivwits Reservation	25	2.6	-	5	25
Southern Paiute Tribe in Nevada					
Moapa Reservation	43	4.7	-	40	-
Las Vegas Colony	28	3.5	3	-	10

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[1]Some data adjustments have been made to resolve conflicts among data sources.

[2]This figure, derived in field work during the summer of 1980, conflicts with a 1979 IHS estimate of 82 units within colony boundaries.

[3]Tribal goals include provision of standard housing for all off-reservation members desiring to return; estimated numbers are not available.

[4]The Nevada rate (1980) is 2.59; the Utah rate (1980) is 3.2.

Source: Facilitators 1980; Jameson 1981.

made available to most reservations on an as-needed basis; in some cases, there is a small tribal police force.

Private Services. Rural reservations are lacking in private services for the most part and members depend on towns for their required good and services. This may entail trips of 100 mi or more. Colonies, on the other hand, have ready access to goods and services from the towns they are near.

Detailed descriptions of the community infrastructure of the reservations and colonies in the study area is described in detail in Section 4.5.1 of ETR-21.

Archaeological and Historical Resources (3.2.3.10)

National and State Register Properties (3.2.3.10.1)

The National Register of Historic Places is the nation's official list of properties worthy of preservation for significance in American history, architecture, archaeology, and culture. Many other sites are eligible for nomination to the National Register.

Within the study area, all historic and prehistoric properties listed on or pending nomination to the National Register are shown in Tables 3.2.3.10-1 through 3.2.3.10-4, and graphically are presented in Figure 3.2.3.10-1. In the Nevada study area, there are 54 properties listed on the National Register and 4 properties pending nomination or in preparation for nomination. In the Utah study area, there are 58 properties listed in the National Register and 4 properties pending nomination. Utah has a State Register of Historic Places that includes forty-one sites, and one pending nomination. The recently established State Register in Nevada contains no entries as yet.

Archaeological Resources (3.2.3.10.2)

The resource base may be evaluated within a cultural history framework for the Great Basin (Hester 1973: Aikens 1978a; Heizer and Hester 1978; etc.). Five broad periods are defined: an early, Pre-Archaic or Paleo-Indian period, before 8,000 BP; the Archaic period, from possibly 8,000 BP to AD 500; the Formative period, from possibly AD 400-AD 1200; a Post-Formative or Late-Archaic period, from AD 500 to historic times; and an Historic period, since AD 1850.

Pre-Archaic sites are generally located in the vicinity of Pleistocene lakes and rivers, suggesting an economic focus on lucustrine resources. The large fluted points at these sites suggest that extinct fauna such as mammoth, camel, and giant bison were hunted in this region. Although surface finds are common, temporal dimensions, cultural affiliations and relationships are poorly understood.

The Archaic period is characterized by broad-spectrum hunting and gathering by small groups who moved frequently following the seasonal and geographical distributions of food resources. The yearly cycle was one of movement from mountains to valley bottoms, and back to the mountains. This pattern is only generally descriptive and does not apply to well-watered areas within the Great Basin. For example, groups residing near riverine and marsh ecosystems had access to abundant, regularly available resources that could be brought back to the base

Table 3.2.3.10-1. Entries in the National Register of Historic Places within the Nevada study area. (Page 1 of 2)

Key	Name	Type of Entry	County
1	Fort Ruby[1]	Site	White Pine
2	Leonard Rock Shelter[1]	Archaeological Site	Pershing
3	Austin	District	Lander
4	Berlin	District	Nye
5	Cold Springs	Site	Churchill
6	Grimes Point	Archaeological Site	Churchill
7	Las Vegas Mormon Fort	Site	Clark
8	Fort Schellbourne	Site	White Pine
9	Ward Charcoal Ovens	Site	White Pine
10	Bristol Wells Town Site	Site	Lincoln
11	Belmont	District	Nye
12	Eureka	District	Eureka
13	Caliente R.R. Depot	Building	Lincoln
14	Aurora	District	Mineral
15	Potosi	Site	Clark
16	James Wild Horse Trap	Site	Nye
17	Tybo Charcoal Kilns	Structures	Nye
18	Tim Springs Petroglyphs	Archaeological Site	Clark
19	Mormon Well Spring	Site	Clark
20	Corn Creek Campsite	Site	Clark
21	Sheep Mountain Range Archaeological District	District	Clark
22	Hidden Forest Cabin	Building	Clark
23	Ruby Valley Pony Express Station	Building	Elko
24	Rhodes Cabin (No. 19)	Building	White Pine
25	Lehman Orchard and Aqueduct (No. 22)	Site	White Pine
26	Stillwater Marsh	Site	Churchill
27	Black Canyon Petroglyphs	District	Lincoln
28	Kyle Ranch	Site	Clark
29	Humboldt Cave	Archaeological Site	Churchill

Table 3.2.3.10-1. Entries in the National Register of Historic Places within the Nevada study area. (Page 2 of 2)

Key	Name	Type of Entry	County
30	Sandstone Ranch	District	Clark
31	Sunshine Locality	Archaeological District	White Pine
32	Lincoln County Courthouse	Building	Lincoln
33	Cold Springs Pony Express	Site	Churchill
34	White River Narrows Archaeological District	Archaeological Site	Lincoln
35	Las Vegas Springs	Site	Clark
36	Sloan Petroglyphs	Archaeological Site	Clark
37	Westside School	Building	Clark
38	Tule Springs (aka Floyd Lamb State Park)	Archaeological Site	Clark
39	Gatecliff Rockshelter	Archaeological Site	Nye
40	Mizpah Hotel	Building	Nye
41	Bunkerville Historic District	District	Clark
42	Pueblo Grande de Nevada	Site	Clark (Lake Mead area)
43	Emigrant's Trail	Site	Nye
44	Blacksmith Shop	Building	Clark
45	Las Vegas Wash	Archaeological District	Clark
46	Mesquite House	Building	Clark
47	Archaeological Sites AZ-F:5:1; AZ-F:5:2	Sites	Clark
48	Tule Springs Divorce Ranch	Buildings	Clark
49	Hoover Dam	Buildings/Structure	Clark
50	Lahontan Dam and Power Plant	Structure	Churchill
51	Nevada-California Power Company Substation	Building	Nye
52	Carson River Diversion Dam	Structure	Churchill
53	Consolidated Cortez Silver Company Mine and Mill	Buildings	Eureka
54	Sand Springs Station	Building	Churchill

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[1]National Historic Landmark

Table 3.2.3.10-2. National register nominations currently in preparation in the Nevada study area.

Key	Name	Type of Entry	County
A	Pine Valley Archaeological District	Archaeologic District	Eureka
B	Goldfield Hotel	Building	Esmeralda
C	Desert Queen Mine	Structure	Nye
D	Delamar	Historic District	Lincoln

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Table 3.2.3.10-3. Entries in the National Register of Historic Places within the Utah study area (Page 1 of 3).

Key	Name	Type of Entry	County
55	Tintic Mining District Multiple Resource Area	District	Juab
56	Archaeological Site (No. 42MD300)	Archaeological Site	Millard
57	Long Flat Site (42 In 330)	Site	Iron
58	Edwin Robert Booth House	Building	Juab
59	Beaver County Courthouse	Building	Beaver
60	Thomas Frazer House	Building	Beaver
61	Fort Cameron	Site (buildings)	Beaver
62	Wildhorse Canyon Obsidian Quarry	Site	Beaver
63	George H. Wood House	Building	Iron
64	Old Irontown	Site (buildings)	Iron
65	Gold Spring	Site	Iron
66	Parowan Rock Church	Building	Iron
67	Jesse N. Smith House	Building	Iron
68	Parowan Gap Petroglyphs	Archaeological Site	Iron
69	George Carter Whitemore Mansion	Building	Juab
70	Nephi Mounds	Archaeological Site	Juab
71	Cove Fort	Site (building)	Millard
72	Topaz War Relocation Center Site	Site (buildings)	Millard
73	Fort Deseret	Site	Millard
74	Utah Territorial Capitol	Building	Millard
75	Gunnison Massacre Site	Site	Millard
76	Pharo Village	Archaeological Site	Millard
77	Lincoln Highway Bridge	Object	Tooele
78	Iosepa Settlement Cemetery	Site	Tooele
79	Benson E. T. Mill	Buildings	Tooele
80	Bonneville Salt Flats Race Track	Race Track	Tooele

Table 3.2.3.10-3. Entries in the National Register of Historic Places within the Utah study area (Page 2 of 3).

Key	Name	Type of Entry	County
81	Wendover AFB	Buildings	Tooele
82	Mountain Meadows Historic Site	Site	Washington
83	Hurricane Canal	Object	Washington
84	Pine Valley Chapel and Tithing Office	Buildings	Washington
85	Deseret Telegraph and Post Office	Buildings	Washington
86	Jacob Hamblin House	Buildings	Washington
87	Wells Fargo and Co. Express Building	Building	Washington
88	Cable Mountain Draw Works	Buildings	Washington
89	Thomas Judd House	Building	Washington
90	Old Washington County Courthouse	Building	Washington
91	St. George Tabernacle	Buildings	Washington
92	St. George Temple	Building	Washington
93	Brigham Young Winter Home and Office	Buildings	Washington
94	Wallace Blake House	Building	Washington
95	Robert D. Covington House	Building	Washington
96	Washington Cotton Factory	Building	Washington
97	Fort Pearce	Site	Washington
98	Dr. George Fennemore House	Building	Beaver
99	Duckworth Grinshaw House	Building	Beaver
100	David Muir House	Building	Beaver
101	Harriet S. Sheperd House	Building	Beaver
102	Charles Dennis White House	Building	Beaver
103	Paragonah Site	Archaeological Site	Iron
104	Fish Springs Caves	Archaeological District	Juab
105	Tintic Standard Reduction Mill	Building	Juab
106	Soldier Creek Kilns	Objects	Tooele

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Table 3.2.3.10-3. Entries in the National Register of Historic Places within the Utah study area (Page 3 of 3).

Key	Name	Type of Entry	County
107	Gapa Launch Site and Blockhouse	Buildings	Tooele
108	Dixie College Main Building	Building	Washington
109	Fort Harmony	Site	Washington
110	Naegle Winery	Site	Washington
111	Washington Relief Society Hall	Building	Washington
112	Woodward School	Building	Washington

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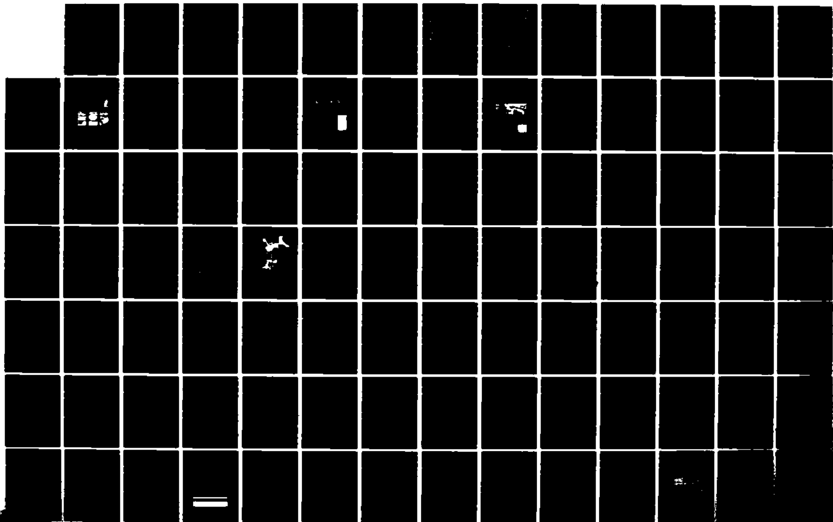

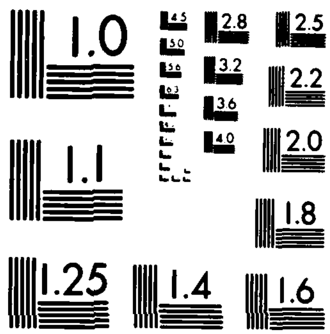
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Table 3.2.3.10-4. National Register nominations currently in preparation in the Utah study area.

Key	Name	Type of Entry	Location
A	Wendover	Site	Tooelle County
B	German Village	Site	Tooelle County
C	Sand Cliff Signature	Site	Iron County
D	Parowan 3rd Ward	Building	Iron County

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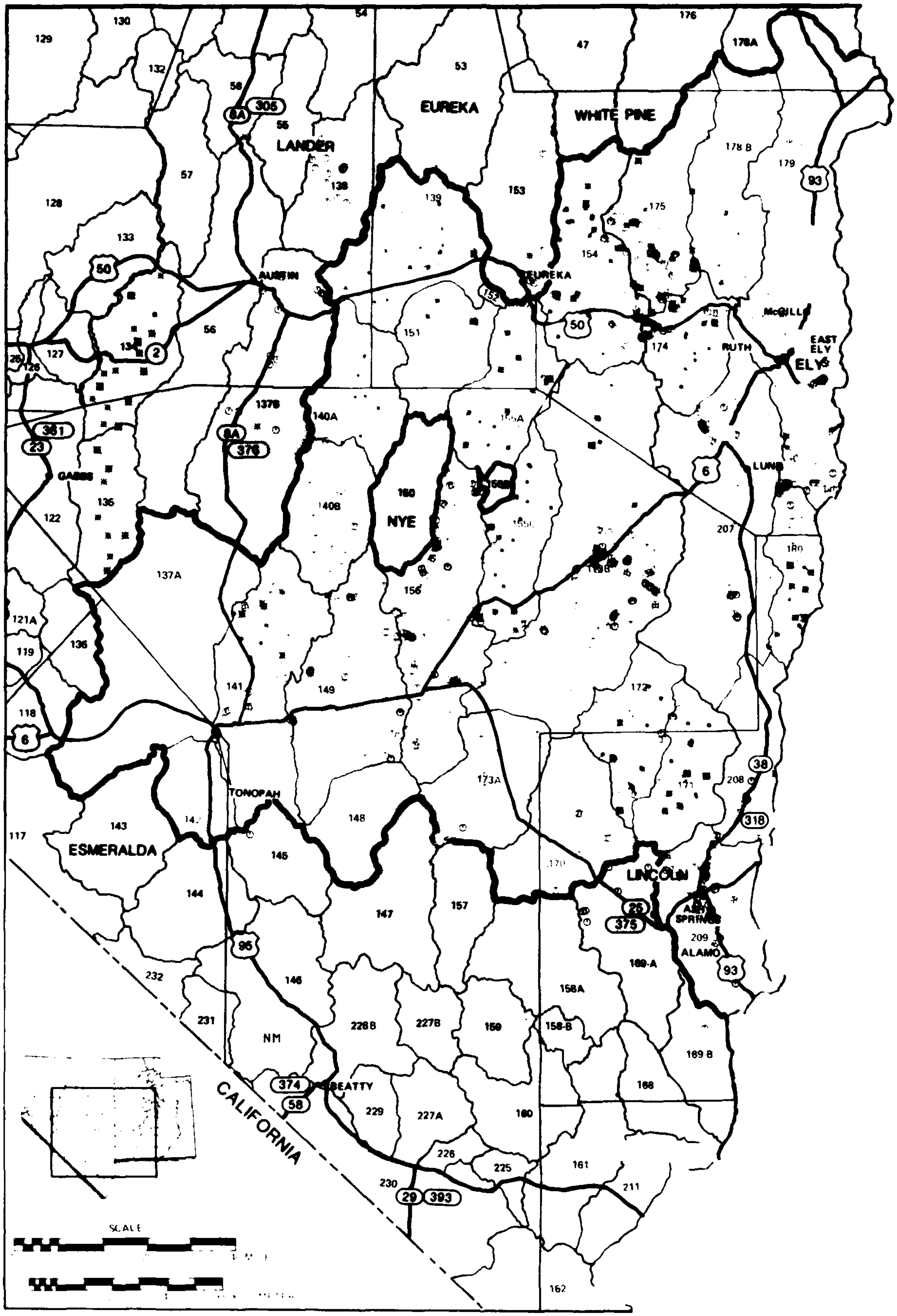

LANDER
EUREKA
WHITE PINE
NYE
ESMERALDA
LINCOLN
CALIFORNIA
AUSTIN
EUREKA
McGILL
EAST ELY
ELY
RUTH
LUND
TONOPAH
GABBS
ASH SPRINGS
ALAMO
BEATTY
NM
SCALE

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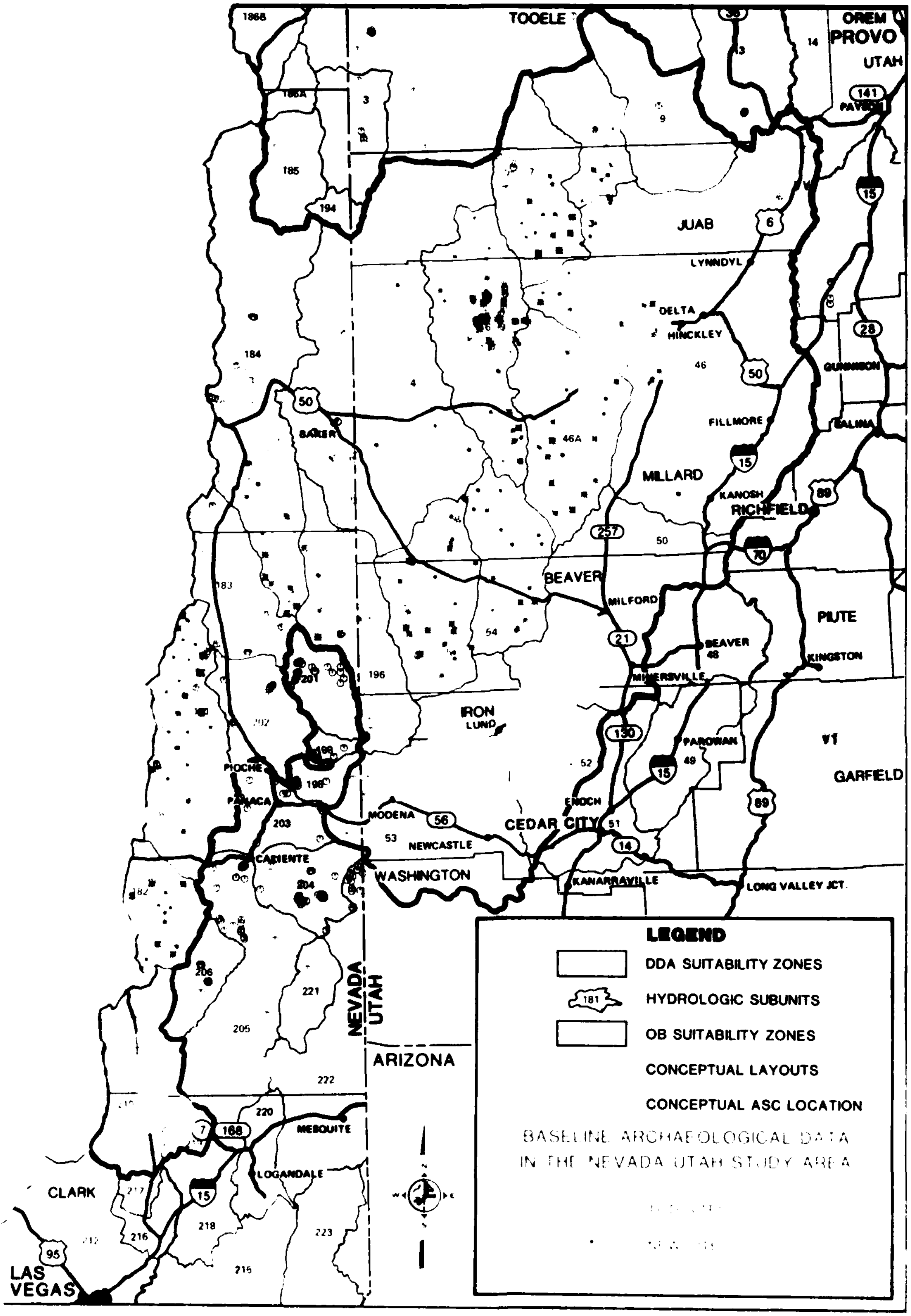

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Figure 3.2.3.10-1. Archaeological and historical sites currently listed in the National Register of Historic Places.

camp, rather than moving the camp to the resources. Such resources possibly allowed larger, more sedentary, and even permanent occupations.

While the Archaic period may be generally described as above, Archaic subsistence strategies were undoubtedly more complex, reflecting short and long term climatic changes, as well as the diverse micro-environments characterisitic of the Great Basin. Such diversity makes generalizations about settlement and subsistence difficult beyond an individual valley.

Formative groups include the Fremont and Sevier of the eastern Great Basin, and the Virgin River Anasazi who occupied the Virgin, Muddy, Moapa river bottomlands in southern Nevada and Utah.

Traditionally, Formative groups are those dependant upon horticulture and the gathering of wild resources. Madsen (1979), however, argues this generalization masks a great diversity in settlement and subsistence patterns. He suggests Sevier groups primarily lived near marshes, which provided the bulk of their diet. Corn was utilized only as a dietary supplement. In contrast, the Fremont of the Colorado Plateau lived near streams and relied heavily on cultivated crops. Similarly, the Virgin River Anasazi relied heavily on domestic crops, although they ranged far in pursuit of wild plants, game, and trade.

Again, these descriptions are exceedingly general; group-specific settlement and subsistence strategies were more complex, reflecting local micro-environmental differences, short-term climate changes, and inter-group competition.

The Post-Formative Late-Archaic period begins with the arrival in ca. AD 1200 of Numic-speaking groups migrating from more southwestern areas. They exploited the full range of ecozones in some areas, and focused upon "key resources" in others, as in the Western Archaic pattern. In the Sevier area, the Late-Archaic pattern may be coexistent with, and successive to, the Sevier culture. Madsen (1975) suggests that the Fremont and Shoshone occupied the same Utah/Nevada border areas for 1,000-2,000 years. Resource competition between the two may have been a factor in the disappearance of the Fremont. In the Western Great Basin, some Numic speaking groups continued a pattern of adaptation to lucustrine or riverine resources, e.g., at Walker and Pyramid Lakes.

Historic exploration in the Great Basin began in 1776 with the arrival of the Escalante-Dominguez party at Utah Lake and along the southern Wasatch front. The numerous trappers, traders, and explorers which followed left little physical evidence of their presence.

Significant Euroamerican settlement began when the Mormons entered the Great Basin in 1847. They established a pattern of nucleated settlements with farm lands around the perimeters of the communities. This pattern was both for defensive and socio-religious purposes (Nelson 1952). Farmers travelled out to their irrigated plots and returned at night or on weekends. Cattle and sheep herds were grazed by communal herders (animals were individually owned) in upland areas and on other grassland areas beyond the farm perimeters.

Between 1859 and the early 1900s much of the Great Basin was the scene of numerous and varied mining booms (Elliot 1966, 1973; Hulse 1971). Most are well-

known historically-- The Comstock, Austin, Belmont, Pioche, Delamar, White Pine, Tonopah, Goldfield, etc. But in addition to the major boom locales (with their towns, mills, headframes, etc.), numerous farmsteads and small ranches developed to feed the mining communities. The settlement pattern was extensive, with wide areas separating homesteads.

Since the early mining booms, development in Nevada and Utah has been stimulated by more recent mining activities, public works projects like Boulder Canyon Dam, defense-related facilities like Nellis Air Force Range and Dugway Proving Ground, and, particularly in Nevada, by tourism.

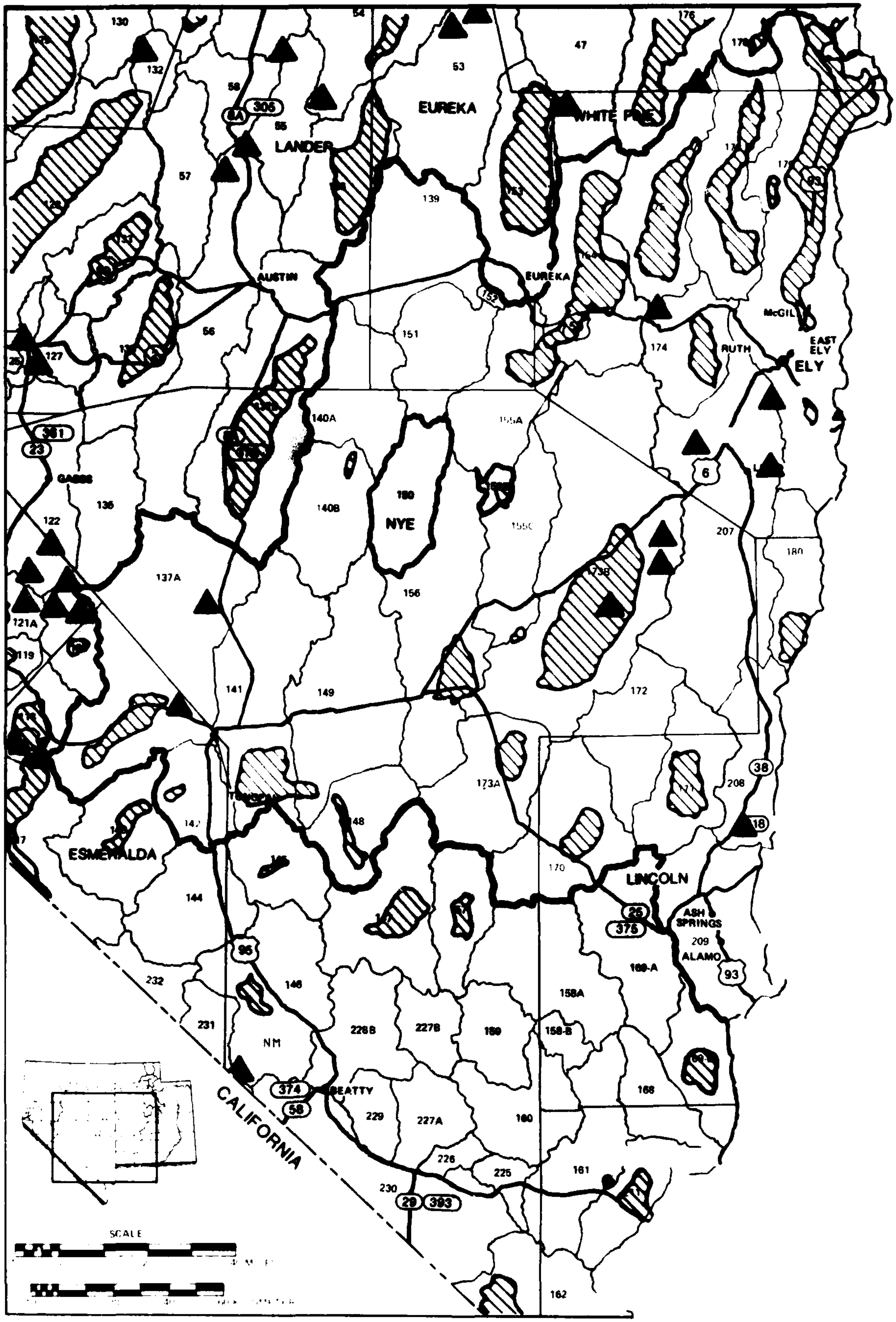
The above generally describes a number of man-land relationships and illustrates how resources have a strong determining effect on the nature and distribution of human activities and their material remains. To provide more useful information for planning the location of the M-X Missile System, baseline data illustrated in Figure 3.2.3.10-2, were gathered to accomplish the following tasks:

- o identify more precisely man-land relationships in the study area
- o quantify these relationships with site density descriptions of topographic and vegetative strata
- o describe hydrologic subunits according to these strata and their site densities
- o identify and compare the impacts of the Proposed Action and the alternatives on the archaeological resources in the area
- o formulate specific facility siting guidelines for minimizing impacts to archaeological resources.

Baseline data is derived from existing site records, a survey of the Nellis Air Force Range, a recent 100 sq mi survey in Nevada and Utah, and several small, intensive surveys within the study area.

It should be noted that a small portion of this baseline consists of historic sites. This baseline and that described in Historical and Architectural Resources (Section 3.2.3.10.3) are mutually exclusive. The latter baseline consists of places named in archival records. The few historical resources included in the archaeological baseline are primarily unnamed sites and isolates dating to the historic period.

Records of 1969 prehistoric sites and isolates were obtained from the Nevada State Museum, the Utah Division of State History, various BLM offices, and other repositories. Records on 116 historic isolates were also obtained. These resources have been classified into four major types of sites. Multiple activity (MA) sites generally include habitation sites such as villages, seasonal campsites, rockshelters, homesteads, and mining camps. Special purpose (SP) sites are exemplified by rock art cemetaries, cairns and rock alignments and churches. Limited activity (LA) sites are those sites which exhibit either short-term use or represent only a limited range of activities. Some examples of these sites include small lithic scatters, short-term campsites, isolated features, refuse dumps, corrals, sherd scatters, and



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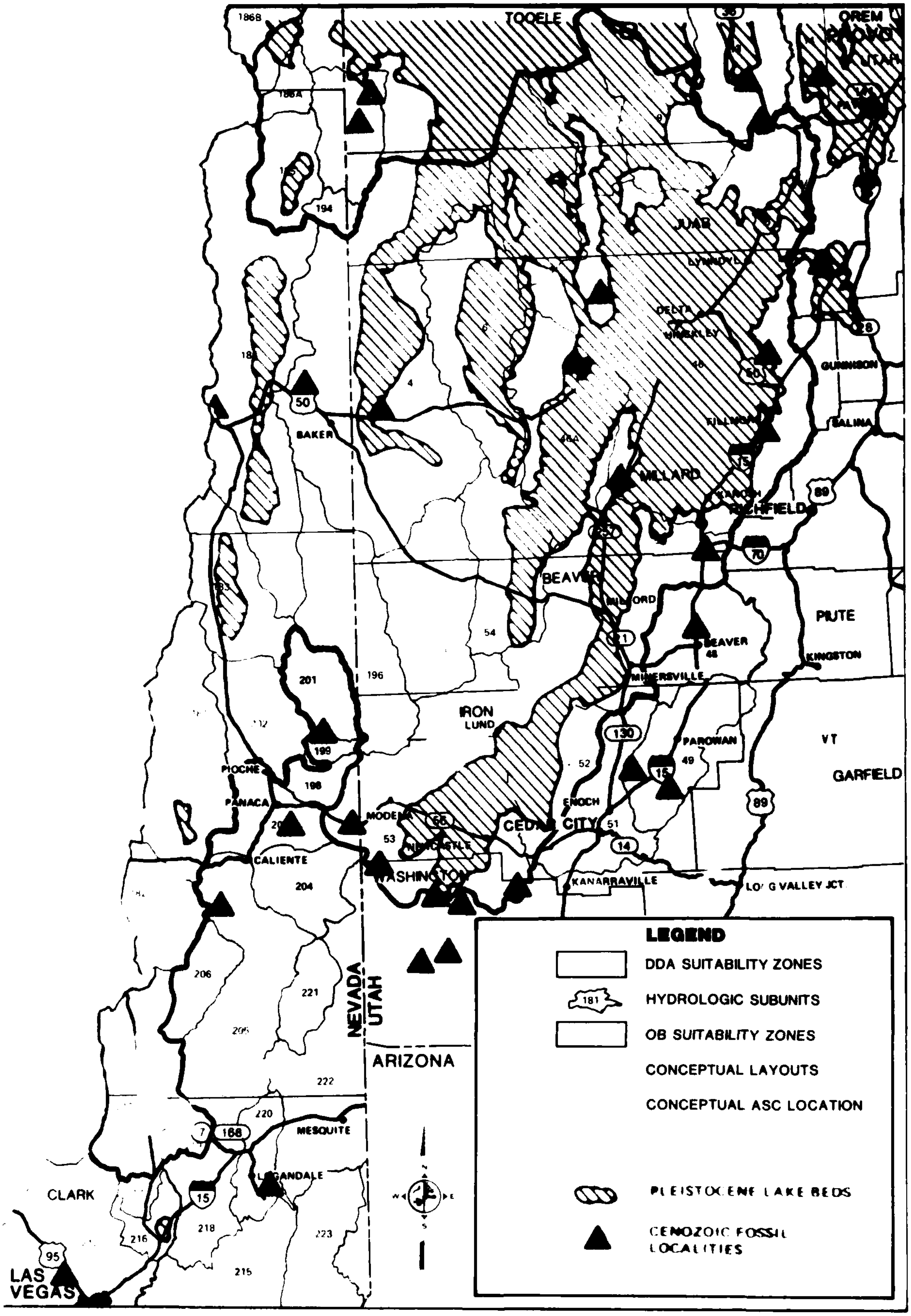

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Figure 3.2.3.10-2. Pleistocene lake beds and Cenozoic fossil localities in the Nevada/Utah study area.

trails. The fourth, Isolated finds can include an isolated artifact of human manufacture or use, including projectile points, flakes, ceramics, groundstone, bottles, and tin cans. Multiple activity, special purpose, and limited activity sites are likely to be eligible for inclusion in the National Register of Historic Places. Isolated remains, when considered in a regional context, have the research potential to answer specific questions but do not qualify for National Register eligibility. In the following, isolates are cited as part of the baseline, but extreme variations in recording practices have forced their exclusion from analysis.

The existing site data base was used to examine the distribution of prehistoric MA and LA sites by topographic zone and landform. This data base was not amenable to an analysis of site distribution in relation to vegetation types, however. Such distributional data were obtained from a large, intensive survey of Nellis Air Force Range. The Nellis data also permitted a detailed exploration of the spatial patterning of archaeological resources associated with springs, an important stratum in the study area. The Nellis data base consists of 464 prehistoric and historic sites and isolates.

The above sets of data provided the basis for identifying zones of high archaeological sensitivity. These zones were refined by the analysis of data derived from a 100 sq mi survey of 31 hydrologic subunits, or watersheds, in Nevada and Utah. This systematic survey identified 966 sites and isolates, including 405 prehistoric sites, 451 prehistoric isolates, 54 historic sites, and 56 historic isolates. Analysis of this data base isolated new sensitivity zones and permitted the calculation of their site densities.

The last segment of the baseline data is derived from recent surveys in Coyote Spring (EDAW 1981a), Wah-Wah Valley (Ertec 1981) and the Beryl/Milford area (EDAW 1981b). These small surveys provide site density data for areas not adequately sampled during the 100 sq mi survey. A total of 58 sites and 66 isolates were located during these summaries.

In sum, the baseline data consists of 3,649 prehistoric and historic sites and isolates. This data allows the calculation of site densities for topographic and vegetative strata within the M-X study area. Methods used in the calculation of site densities are described in ETR-23, "Archaeology." The densities are listed below and suggest that areas within a one mi radius of springs, streams, and playas have high site densities. Densities fall off rapidly with increasing distance from the one mile zones. These data are consistent with common sense notions about human behavior in arid environments. The high density in the Pinyon-Juniper stratum is also expected because of the abundance of wild plant and animal resources in these forested areas.

STRATUM	DENSITY (sites per sq mi)
Springs (0-1 mi radius)	7.12
Springs (1-2 mi distance)	3.28
Streams (0-1 mi radius)	6.88
Streams (1-2 mi distance)	3.00
Playa Margin (0-1 mi radius)	12.00
Open Fan*	5.20
Other Valley**	1.68
Pinyon-Juniper	13.00

* Category includes all remaining valley areas from Fish Springs (7) and Little Smokey (155 A-C) valleys only.

** Includes all remaining valley areas from valley not in the Open Fan category.

Historical and Architectural Resources (3.2.3.10.3)

The historic resources in the Nevada/Utah study area reflect its settlement. Several historic exploration trails, numerous ghost towns, mining camps, homesteads, stage stations, railroad lines and stations, stamp mills, and ranches are present. Typically these resources can be expected near water sources and in the foothill and mountain zones. Archival research has identified 1,372 historic sites named within the study region. These are listed and graphically presented in ETR-23, Section 2.3.2. This area has undergone a series of economic booms, followed by periods of decline, with the architecture of cities and towns reflecting these cycles. The most obvious remnants of these cycles are the numerous ghost towns.

Abandonment, neglect, and theft of materials have reduced the number of architecturally significant properties. However, the lack of intense development in many small communities has helped preserve the architectural integrity of the now significant structures. Other architectural resources include residences, pony express and stage stations, military forts, and other isolated structures.

Paleontological Resources (3.2.3.10.4)

Paleontology in the Nevada/Utah region is divided into two basic types: those fossils of Paleozoic age, 225 to 590 million years, found in the mountain ranges, and those of Cenozoic age, 10,000 to 60,000 years, found mainly in the valleys and along the mountain fronts. Paleozoic fossils occur in most of the mountain ranges in Nevada and western Utah, except those made up of Cenozoic volcanic rocks, and the Snake Range, which is largely metamorphic. Cenozoic fossil occurrences are scattered throughout the area. Figure 3.2.3.10-2 shows some of the known localities. ETR-11, Chapter 6 provides a more complete discussion of paleontology.

Construction Resources (3.2.3.11)

The M-X system will require substantial quantities of a number of construction resources. The resources that are discussed in more detail were selected because of the large quantity required, such as aggregate and lumber; the

possibility of scarcity, such as asphaltic oil and cement; or a combination of both, such as water. These resources are personnel, water, cement, steel, asphaltic oil, aggregate, and lumber. Personnel is discussed in Chapter 2 and ETRs 27 and 31. Water is discussed in Chapter 2 and ETR-12.

Cement (3.2.3.11.1)

For an M-X system based in Nevada/Utah, the potential supply region covers the eleven western States. The levels of production for the 11-state regional market over the recent past are given in Table 3.2.3.11-1, reaching in excess of 17 million tons in 1978. Of this total, however, over 50 percent originates in California. Demand just exceeds production, though regional output is considerably below present plant capacity levels with a capacity utilization for the region of 73 percent over the period 1973-1978 (Table 3.2.3.11-2).

At the more local level, however, demand exceeds capacity in both Nevada and Utah by 42 and 18 percent, respectively, in 1979. Assuming the 11-state cement plant capacity utilization level of 73.7 percent over the period 1973-1978, these percentage shortfalls rise to 93 percent for Nevada and 60 percent for Utah. Over the period 1960-1978, the average regional shortfall has amounted to 105,000 tons/year (see ETR-25).

Steel (3.2.3.11.2)

Most of the steel used by the M-X system will be in the form of reinforcing bar steel (rebar) employed in reinforced concrete construction. The production of rebar takes place in plants much smaller in size than those for iron or steel, and much more frequent in their geographical distribution. Producers of rebar exist in a number of states considered to be within the M-X supply region: California, Oregon, Washington, Utah, Arizona, and Colorado. Their combined estimated capacity as of 1979 was over 1.5 million tons annually, which exceeds the regional consumption by over half a million tons.

Asphaltic Oil (3.2.3.11.3)

The demand for asphaltic oil originates from two sources: as a component of the asphalt surface for the DTN, of which it makes up 5.6 percent by weight; and as road bed coating and sealing oil. Approximately 75 percent of the asphaltic oil produced in the United States is used for various types of pavement construction, such as roads, streets, and parking lots. In 1980, pavement construction was low enough that the asphaltic oil producers reduced their production to about 75 percent of their capacity. Although there are indications that pavement construction will increase, the demand for asphaltic oil will not approach the refinery capacity to produce it.

In the Nevada/Utah region, five states are probable asphaltic oil suppliers. These states are Utah, California, Oregon, Wyoming, and Colorado (Nevada does not produce asphaltic oil). As of January 1, 1981, these five states have a total annual asphalt production capacity of almost 1.6 billion gal, or 6 million tons (Oil and Gas Journal, March 30, 1981). The total demand for asphaltic oil for the M-X system is about 0.14 billion gal, or 0.5 million tons, over an eight-year period. This total demand represents only about 8 percent of production capacity for a single year.

Table 3.2.3.11-1. Nevada/Utah market area production of portland cement by district, 1960-1978 (thousands of tons).

Year	Wyoming, Montana, and Idaho	Colorado, Arizona, Utah, and New Mexico	Oregon and Nevada	Washington	California	Total
1960	490	2,238	—[1]	1,550[2]	7,498	11,776
1961	524	2,581	—[1]	1,393[2]	7,738	12,236
1962	576	2,550	—[1]	1,352[2]	8,239	12,717
1963	680	2,549	—[1]	1,466[2]	8,664	13,359
1964	688	2,413	—[1]	1,550[2]	9,019	13,670
1965	677	2,222	704	1,143	8,491	13,237
1966	694	2,191	804	1,166	8,519	13,374
1967	655	2,063	638	1,106	7,905	12,367
1968	718	2,274	680	1,189	8,849	13,710
1969	880	2,263	657	1,189	9,542	14,531
1970	845	2,598	740	1,254	9,412	14,849
1971	942	2,954	840	1,324	9,105	15,165
1972	956	3,145	831	1,426	9,392	15,750
1973	1,047	3,441	908	1,462	9,502	16,360
1974	1,092	3,351	916	1,389	3,202	14,950
1975	1,005	3,295	858	1,379	7,211	13,748
1976	1,044	3,524	912	1,391	7,892	14,763
1977	1,118	3,858	904	1,636	9,040	16,556
1978	1,058	3,899	1,006	1,880	9,315	17,158

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[1]Production data for Oregon included in Washington's total; no production data for Nevada until 1965.

[2]Washington's production includes Oregon from 1960-1964.

Source: U.S. Department of the Interior, Bureau of Mines, Minerals Yearbook.

Table 3.2.3.11-2. Portland cement capacity utilization, Nevada/Utah market area, 1973-1978 (percent).

Year	Wyoming, Montana, and Idaho	Colorado, Arizona Utah, and New Mexico	Oregon and Nevada	Washington	California
1973	86.3	72.4	65.6	64.7	83.1
1974	89.6	62.3	66.1	61.5	74.3
1975	83.1	57.9	61.9	65.0	65.3
1976	85.6	62.1	65.8	67.2	73.0
1977	93.2	71.7	65.2	78.0	82.0
1978	88.2	70.3	75.9	89.7	83.3
Six Year Average	87.7	66.1	66.8	71.0	76.8

T3729/10-2-81

Source: U.S. Department of the Interior, Bureau of Mines, Minerals Yearbook, 1979.

There should be no problems in obtaining all the asphaltic oil needed for M-X construction in Nevada/Utah.

Aggregate (3.2.3.11.4)

Aggregate is a naturally occuring resource that is transported relatively short distances because of its low value and bulky nature. Aggregate is a component of the concrete used in shelter and building construction, and of the asphalt surface used for DTN construction. It is also used as a base or surface for other road construction. The estimated total amount of aggregate required for M-X construction in the Nevada/Utah region for full deployment could be approximately 55 million cu yd (split deployment in Nevada/Utah would require about one-half the amount).

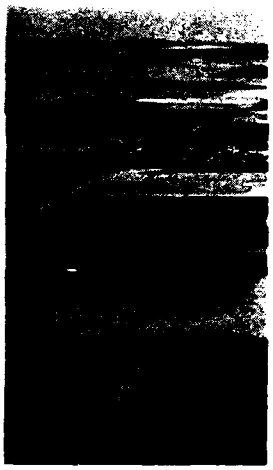
ERTEC Western, Inc. has performed detailed aggregate resource studies for six locations in the Nevada/Utah deployment region. The six locations studied were Pine and Wah Wah valleys in Utah; and Delamar, Muleshoe, Dry Lake, and Pahroc valleys in Nevada. Each of these studies was published as a report for the Air Force in May and June of 1981. All six reports have stated that "there are sufficient quantities of aggregate available for the construction of the M-X missile system" in each of the locations investigated. Additional studies have been conducted in ten other valleys in the Nevada/Utah deployment area. Although not as comprehensive as the detailed studies, results indicate sufficient quantities of aggregates are available for M-X construction. There is no indication that valleys where aggregate studies have yet to be performed will not show the same results.

Lumber (3.2.3.11.5)

Lumber is used primarily for building construction in the OBs. The estimated total amount of lumber for full deployment in Nevada/Utah is approximately 43 million board-ft, with the peak year demand of about 10 million occurring in 1985. Split deployment would require approximately one-half these amounts.

The Western Wood Products Association of Portland, Oregon publishes an annual report on lumber production in the western United States, including the states of Nevada, Utah, and New Mexico. Their "1979 Statistical Year Book of the Western Lumber Industry" states that Oregon, a potential lumber source for the Nevada/Utah alternatives, produced over 3 billion board-ft of lumber in 1979. The total U.S. production normally is about 40 billion board-ft. However, production has been down to about 75 percent of the norm. There should be no supply-demand problem for lumber.

Regional Environment, Texas/New Mexico



REGIONAL ENVIRONMENT, TEXAS/NEW MEXICO

The study area in the Southern High Plains encompasses the Texas Panhandle and eastern New Mexico. The relatively flat land has no well-defined drainage basins and little runoff. The climate is semi-arid, precipitation averaging less than 20 in./year. Dry land and irrigated farming is an important economic activity. Several high-production oil and gas fields are within the area.

The following sections describe the quality of life, and natural and human environmental characteristics of the Texas/New Mexico study area. Included are descriptions of physical and biological resources: Groundwater; Surface Water; Air Quality; Mining and Geology; Vegetation and Soils; Wildlife; Aquatic Species; Protected Species; and Wilderness and Significant Natural Areas. Discussion of the human environment covers: Employment; Income and Earnings; Public Finance; Population and Communities; Transportation; Energy; Land Ownership; Land Use; Native American Resources; Archaeological and Historical Resources and Construction Resources.

DESCRIPTION OF OTHER PROJECTS

The effects of future projects will depend both on their geographic location within the region and their magnitude. To assess project impacts, it is necessary to simulate the future baseline environment. Also, since much of the project effects are driven by labor in-migration, future baseline employment levels must be detailed.

Table 3.3-1 presents the baseline employment forecasts, by place of residence, for the counties in the Texas/New Mexico ROI. These projections are an extrapolation of employment growth trends over the 1967-1977 period indicate modest employment growth through 1994. Over the 1982-1994 period, regional employment is forecast to increase by about 39,000 jobs, to an 343,000 jobs in 1994. This represents average annual growth of 1.0 percent.

From 1982-1994, Texas's share of the total is forecast to increase slightly, from 83.9 percent of total ROI employment in 1982 to 84.7 percent by 1994. As

Table 3.3-1.

TREND-GROWTH BASELINE EMPLOYMENT PROJECTIONS, TEXAS/NEW MEXICO ROI, 1982-1994.

COUNTY	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
BAILEY	3392.	3400.	3409.	3421.	3425.	3433.	3441.	3449.	3457.	3462.	3462.	3462.	3462.
CASTRO	3991.	4013.	4034.	4060.	4078.	4099.	4121.	4142.	4167.	4185.	4207.	4228.	4250.
CHAVES	19803.	20122.	20448.	20777.	21070.	21370.	21674.	21981.	22292.	22570.	22848.	23129.	23414.
COCHRAN	2045.	2045.	2045.	2045.	2045.	2045.	2045.	2045.	2045.	2056.	2072.	2088.	2104.
CURRY	14392.	14438.	14484.	14530.	14536.	14543.	14550.	14556.	14566.	14536.	14510.	14484.	14458.
DALLAM	2347.	2374.	2402.	2432.	2456.	2484.	2511.	2539.	2569.	2607.	2648.	2689.	2730.
DEAF SMITH	8452.	8532.	8612.	8696.	8772.	8851.	8931.	9011.	9091.	9178.	9266.	9354.	9442.
DE BACA	1003.	1003.	1003.	1003.	991.	983.	976.	968.	964.	964.	964.	964.	964.
HALE	15670.	15835.	16004.	16172.	16341.	16510.	16683.	16860.	17032.	17251.	17469.	17691.	17917.
HARDING	534.	524.	514.	509.	494.	484.	473.	463.	453.	433.	412.	392.	372.
HARTLEY	1159.	1184.	1210.	1235.	1261.	1286.	1311.	1337.	1362.	1388.	1413.	1438.	1464.
HOCKLEY	8987.	9044.	9101.	9163.	9224.	9289.	9355.	9420.	9490.	9543.	9600.	9658.	9715.
LAMB	7129.	7121.	7113.	7109.	7109.	7109.	7109.	7109.	7109.	7097.	7089.	7081.	7073.
LUBBOCK	99579.	100999.	102441.	103897.	105082.	106280.	107492.	108717.	109956.	111204.	112465.	113740.	115029.
MOORE	6564.	6591.	6618.	6649.	6681.	6717.	6753.	6789.	6825.	6870.	6914.	6959.	7004.
OLDHAM	853.	859.	865.	871.	884.	896.	909.	921.	937.	953.	971.	990.	1009.
PARMER	4233.	4233.	4233.	4233.	4237.	4245.	4254.	4262.	4274.	4303.	4336.	4369.	4402.
POTTER/RANDALL	82304.	83311.	84334.	85367.	86360.	87362.	88380.	89413.	90455.	91542.	92643.	93760.	94891.
QUAY	4856.	4864.	4873.	4882.	4873.	4864.	4856.	4847.	4843.	4821.	4804.	4786.	4769.
ROOSEVELT	6864.	6889.	6913.	6942.	6971.	7004.	7037.	7070.	7108.	7137.	7170.	7203.	7236.
SHERMAN	1553.	1561.	1569.	1577.	1585.	1593.	1601.	1610.	1622.	1634.	1650.	1666.	1683.
SWISHER	4498.	4515.	4532.	4554.	4583.	4617.	4651.	4686.	4720.	4771.	4822.	4873.	4924.
UNION	2128.	2119.	2111.	2106.	2111.	2119.	2128.	2137.	2150.	2150.	2150.	2150.	2150.
DEPLOYMENT REGION	302335.	305576.	308866.	312229.	315166.	318185.	321239.	324329.	327485.	330652.	333884.	337153.	340459.

SOURCE HDR SCIENCES, BASED ON POPULATION, LABOR FORCE, AND UNEMPLOYMENT DATA FROM STATE SOURCES. CT

indicated in the table, not all counties are projected to grow. Lamb, De Baca, Harding, and Quay counties are all forecast to experience minor employment loss. On the other hand, the counties of Lubbock and Potter/Randall, with well developed economies, are forecast for slightly more rapid growth.

Trend-growth projections include continuation of recent growth trends and some local industrial expansion. Many energy-related projects are also slated for the region during the forecast period, however, the combined effect of these projects is not expected to be great enough to significantly alter the trend-growth projections in Table 3.3-1. The largest of these energy-related projects (including one highway improvement plan) related projects (including one highway improvement plan) are:

- Tolk 1 and Tolk 2 Power Plants
- Interstate 27
- Amoco CO_2 Pipeline
- Shell-Mobil CO_2 Pipeline
- Arco CO_2 Pipeline

A description of these projects, including projected employment levels during the construction and operations phases appears in the "Projected Labor Force, Employment and Unemployment without MX (3.3.3.1.3)" section of ETR-44.

Quality of Life




QUALITY OF LIFE

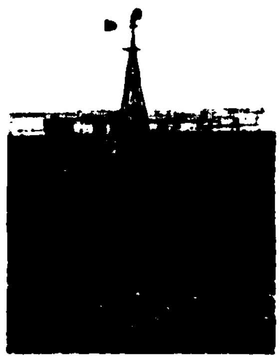
Unlike the rugged, spectacular basin and range topography of the Great Basin in the Nevada/Utah deployment region, the Texas/New Mexico deployment region has comparatively little physical distinction. Long considered a desert (Birdsall and Florin, 1978:255-257), the Great Plains were not settled until the 1870s, but by the following decade ranching had taken hold on the open, unfenced, natural range, supplying cattle to eastern markets. Between 1880 and 1890, the farm frontier began to advance westward due to the development of drought- and frost resistant grains; the evolution of dry-farming techniques; the mechanization of grain farming; the invention of barbed wire; and the development of a cheap, easily erected windmill (Paterson, 1975:261-262). The beef attracted railroads into the region, and towns began to grow. Population greatly increased over the decade as a result, but the early 1890s were years of drought, and the advance of settlement slowed down. From the late 1890s until 1910, precipitation increased again; settlement resumed and the acreage under wheat increased dramatically. With the increased settlement came overgrazing of the ranching areas and unwise cultivation of the wheat areas; as a result, the carrying capacity of the range land was diminished, and the removal of the natural grass cover on the dry plains as a result of wheat cultivation resulted in serious wind erosion (White et al., 1979:317-318; Paterson, 1975:262-263).

Today, most of the Plains area is prosperous, having fully recovered from the catastrophic 1930s. Crop rotations have been improved, with the old sequence of wheat-fallow-wheat-fallow being replaced by longer cycles in which wheat is associated with other crops and planted grasses. Irrigation has provided farmers with increased security against the variable precipitation. In the southern part of the Great Plains, on the High Plains of Texas around Lubbock in particular, irrigation from deep wells (40 meters or more) gradually replaced the earlier dry farming approach. Today, the region is the most important area of cotton production in Texas (Birdsall, 1978:267). One negative result of this massive growth has been a rapid and serious depletion of the subsurface water. New Mexico laws concerning the conservation of underground water are stricter than those in Texas, and adjacent areas in New Mexico have little irrigated land with most of the land still in ranching. The effect of this legal difference is clearly visible from the air or from satellite photos: the subdivided farms of Texas stand in marked contrast to the extensive, unbroken ranches of New Mexico (Birdsall, 1978:267).

Although the Texas and New Mexico cities are growing while many of the villages are stagnating, there is a strong rural orientation to life, particularly in the designated deployment area counties. As in the rest of the country, increasing urbanization is characteristic. However, many of the small towns and villages, have not shared in this growth. Overall, even though the majority of the population is urban, primary production has always been such a significant backbone of the economy that rurally-oriented viewpoints, values, opinions, and judgments are often prevalent (White et al., 1979:318-319).

The essentially rural orientation of the population's value system in both the Nevada/Utah and the Texas/New Mexico regions is an extremely important factor in the consideration of the locals' perception of their quality of life. Dillman and Tremblay note that while rural people's subjective assessments are consistent with the objective conditions of their environment, which point to several areas of deprivation (in terms of economic well being and the receipt of institutional services), they nevertheless evaluate their overall quality of life more positively than do most of their more urban counterparts (Dillman and Tremblay, 1977:115). In essence, rural people believe they have a higher quality of life because the greater weight they attach to the relatively intangible aspects of their environment. Such intangibles include the desirability of their area as a place to raise children; access to the outdoors; open spaces; friendliness of people; air quality; and safety from crime. Thus, in terms of rural residents, and rurally-oriented residents, perception of their quality of life, the inadequacy of certain services and opportunities for economic well-being (as perceived by outsiders) is offset by the presence of other qualities in rural areas (Dillman and Tremblay, 1977:128). This view is partly supported by Goudy, whose research challenges the common assertion that service evaluations are thought to be important factors contributing to the quality of life in small towns and rural areas. His findings show that perceptions of social dimensions, such as the distribution of power, citizen participation, and commitment to the community, are better predictors of any one individual's satisfaction with his or her community (Goudy, 1977:371). Goudy argues that residents find most satisfying those communities in which they think they have strong primary group relationships, where local people participate and take pride in civic affairs, where decision making is shared, where residents are heterogeneous, and where people are committed to the community and its upkeep (Goudy, 1977:380). This does not mean that perceptions of various community services do not relate to community satisfaction, but rather that they appear to be less important than perceptions of social factors. The clear implication is that attempts to increase levels of community satisfaction, or to mitigate the adverse impacts of the project, may not be successful if only services are addressed (Goudy, 1977:371). Thus, residents' satisfaction with their communities may be more greatly affected by forces that disrupt primary group relationships, their sense of participation in, and control of, civic affairs, and take away local residents' decision-making sharing, or by factors that increase the number of transients and others who are not committed to the community, than by anything that subtaxes or reduces local residents' access to community services. Similarly, Ladewig and McCann stress that the most salient subjective experiences are those that reflect the individual's perception of the degree of control he or she has over outcomes he or she experiences in the community, or expects to experience (Ladewig and McMann, 1980:117).

Natural Environment



NATURAL ENVIRONMENT

The following sections describe important physical and biological resources in the Texas/New Mexico study area. Resources described include: Water, Erosion, Air, Mining and Geology, Vegetation and Soils, Wildlife, Aquatic Species, Protected Species, and Wilderness and Significant Natural Areas.

Water Resources (3.3.2.1)

Groundwater Resources (3.3.2.1.1)

In Texas and New Mexico all surface and groundwater in the project area, originates from precipitation. Most of the precipitation returns to the atmosphere by evapotranspiration. The remainder appears as runoff in streams or percolates into the ground recharging underground aquifers.

Rainfall occurs unevenly in the siting area, both seasonally and annually. Additionally, most of the rainfall occurs within short periods of time. As a result, runoff is often excessive and damaging floods are frequent. Mean annual precipitation ranges from 15 to 20 in.

Like rainfall, snowfall in the area is poorly distributed from year to year. Average annual snowfall for the proposed siting area is 15 in.

The amount of lake surface evaporation is influenced by air and water temperature and wind movement over the surface of the water. During wet years when the availability of water is relatively high, net lake surface evaporation rates are low, but during years of drought, evaporation from lakes and transpiration rates of growing vegetation are high and the water supplies are increasingly depleted. Mean annual lake evaporation ranges from 60 to 70 in. per year.

Drought interrupts the flow of water supplies and increases the consumption of stored water. The water-supplying entities of the area must be prepared to store and deliver sufficient quantities of water to meet regular needs and to carry the water users through the drought cycle.

The principal aquifers in the project area are the Ogallala Formation on the High Plains of New Mexico and Texas, and the shallow and artesian aquifers in the Roswell Basin, New Mexico. Numerous other geologic units are considered to be minor aquifers because of inferior storage and production characteristics, and water quality.

The Ogallala Formation (To) is the major aquifer in the project area. Its boundaries in the Texas/New Mexico area, are shown in Figure 3.3.2.1-1, as are the counties affected by the proposed M-X project. The total volume of groundwater potentially recoverable from storage in the Ogallala Formation, within the project area, is approximately 142 million acre-ft. Of this total, approximately 100 million acre-ft is in storage in Texas, as shown in Table 3.3.2.1-1. Average annual depletions from the Ogallala Formation are approximately 2 million acre-ft per year (see Table 3.3.2.1-2). The regions and subregions referred to in these Tables are illustrated in Figure 3.3.2.1-2.

The potential yields of wells that tap the Ogallala Formation generally exceed several hundred gallons per minute.

Recharge to the Ogallala Formation is mainly from precipitation and has been estimated at a fraction of an inch per year (Cronin, 1969). Use of water from the Ogallala Formation is mainly for irrigated agriculture. Relatively large users for municipal supply are the cities of Clovis and Portales, and Cannon Air Force Base in New Mexico.

The artesian and shallow aquifer in the Roswell Basin make up a complex multi-aquifer system in which recharge to the groundwater almost equals removal of groundwater from storage. Production characteristics of the aquifers are excellent; yields of irrigation wells that tap artesian aquifers average 2,000 gpm. The quality of groundwater generally is satisfactory for irrigation and municipal uses; however, encroachment of saline water east of Roswell has occurred as a result of pumping. The aquifers of the Roswell Basin are used mainly for irrigation and for the City of Roswell municipal supply.

The Dakota-Purgatoire Aquifer (dp) is an important aquifer in Regions II and V by virtue of its relatively good water quality and large volume of recoverable groundwater in storage. Projection characteristics of this aquifer are marginal for large-scale groundwater development. However, well yields of several hundred gallons per minute generally are possible where it is overlain by the Ogallala Formation and wells tap both units. The principal water use from this aquifer is irrigation. The largest depletions of groundwater storage from the Dakota-Purgatoire aquifer occur near Clayton in Union County, New Mexico and in Northwestern Dallam County, Texas.

Nearly 4 million acre-ft per year of water were used in the project area in recent years. Of this total, nearly 90 percent was used for irrigation. In the ten Texas counties in the project area, surface water serves relatively few uses and therefore is not tabulated. Present and projected uses of groundwater in these Texas counties are shown in Table 3.3.2.1-3. Surface water is used extensively in some of the seven New Mexico counties in the project area. The present and projected uses of surface and groundwater in these New Mexico counties are shown in Table 3.3.2.1-4. Water use is not available by region in New Mexico. Development of those quantities will take place in subsequent tiering processes.

In the tabulation of water uses, a distinction is made between water withdrawals and water depletion. Water withdrawals are the quantities of water taken from the source for a beneficial purpose. Water depletion is the proportion of the water withdrawn that is no longer available because it has either evaporated,

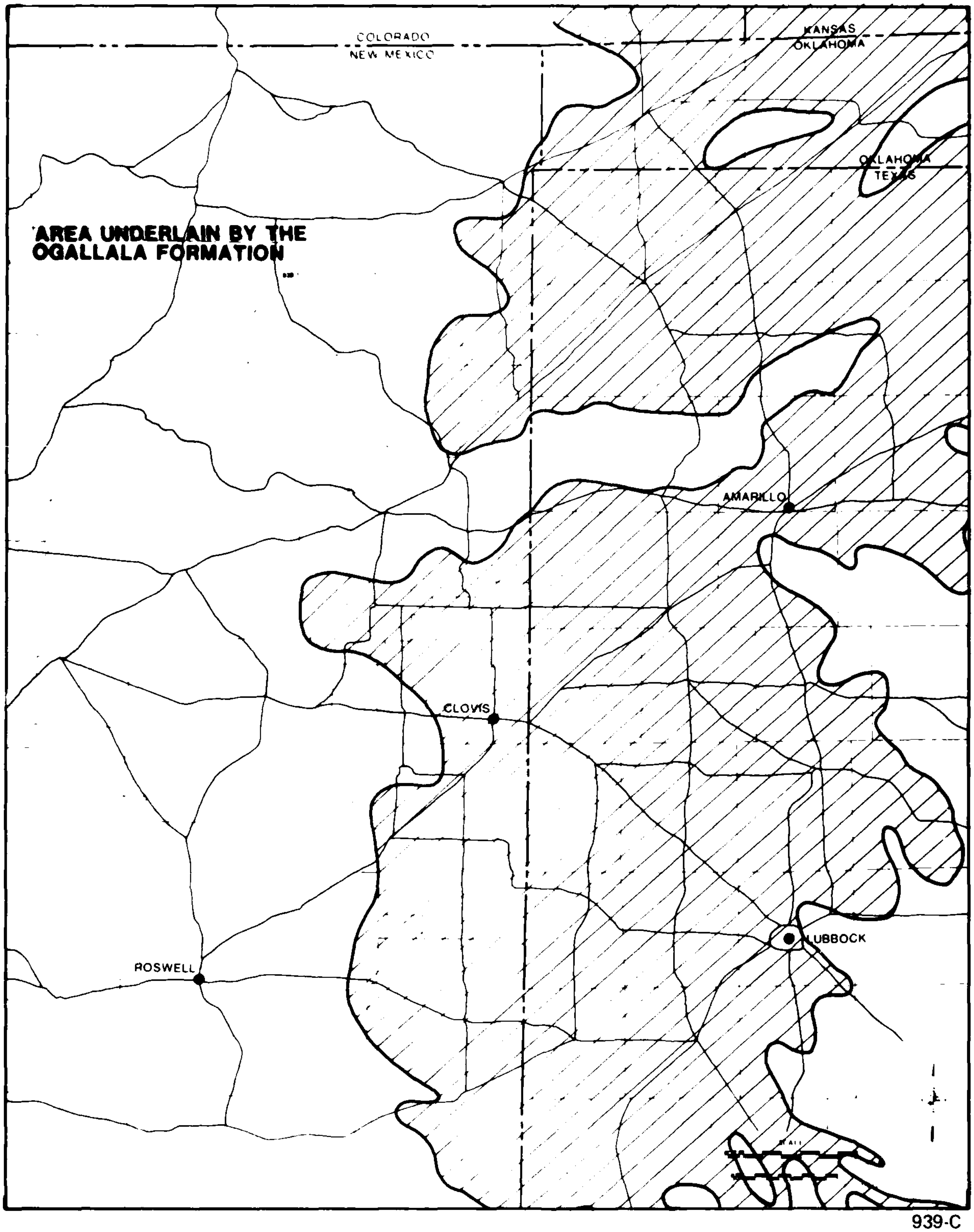


Figure 3.3.2.1-1. Area underlain by the Ogallala formation.

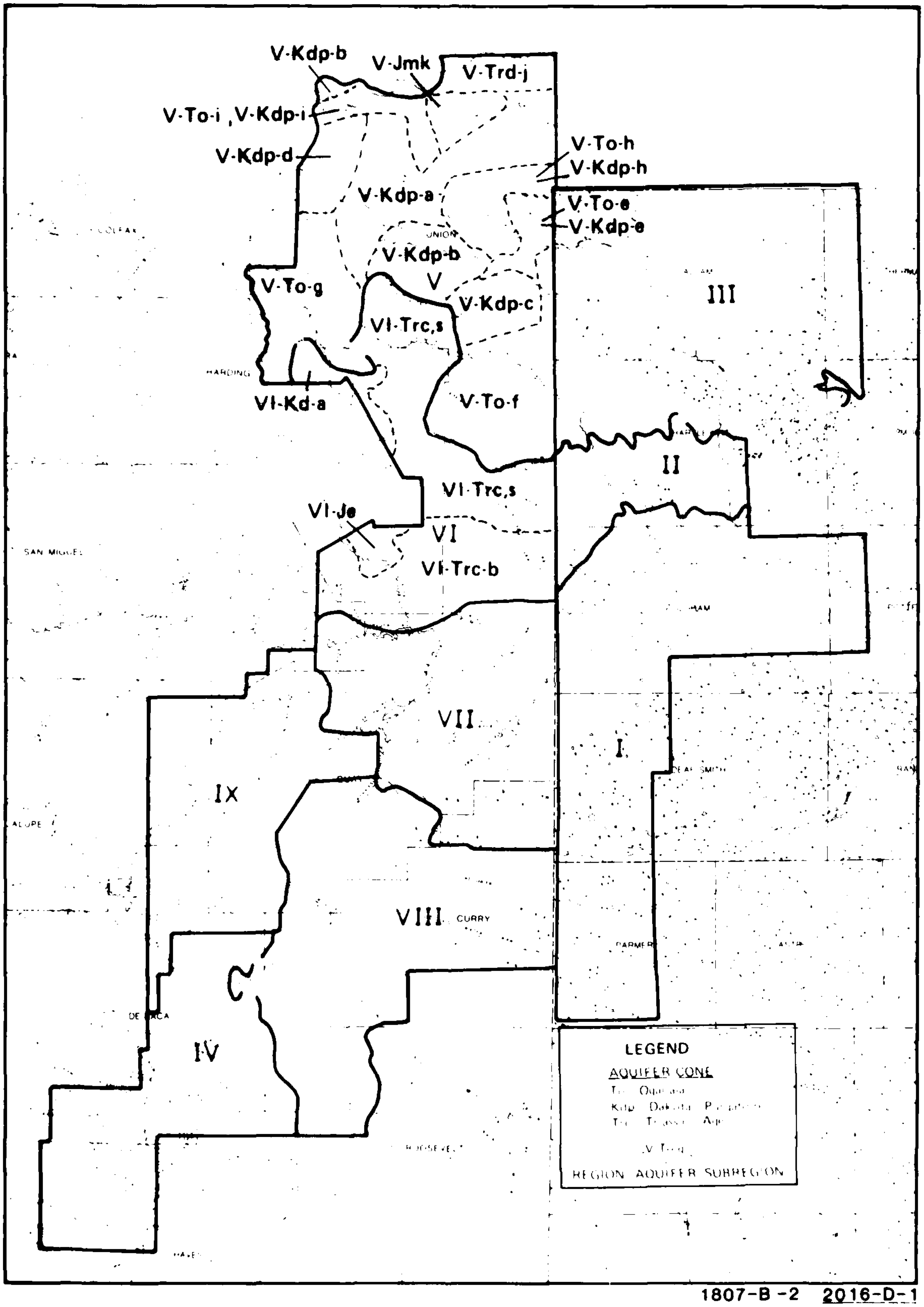


Figure 3.3.2.1-2. Groundwater regions and subregions in the vicinity of the Texas/New Mexico study area.

Table 3.3.2.1-1. Stored groundwater in the Texas/New Mexico study area.

Region[1]	Subregion[2] (Geologic Symbol)	Area (Acres)	Saturated Thickness (Feet)	Specific Yield	Average Well Yield (gpm)	Volume of Groundwater In Storage (10^3 Acre-Feet)	Recoverable Groundwater in Storage[3] (10^3 Acre-Feet)
I	To	--	--	0.15	500	--	28,100[4]
	Ket	--	50	0.10			--
II		--	--	--	200	--	490
III	To	--	--	0.15	700	--	72,100[4]
	Kdp	--	--	0.10	100	--	--
IV	Shallow	--	--	--	500	--	104[5]
	Artesian	--	--	--	2,000	--	184[5]
V	To-e	85,760	25	0.15	250	322	215
	To-f	568,960	75	0.15	550	6,400	4,270
	To-g	344,320	20	0.15	200	1,030	687
	To-h	243,840	25	0.15	250	914	609
	To-i	41,410	25	0.15	250	155	103
	Kdp-a	638,080	110	0.10	95	7,020	4,680
	Kdp-b	384,000	100	0.10	100	3,840	2,560
	Kdp-c	237,440	70	0.10	100	1,660	1,110
	Kdp-d	213,120	50	0.10	100	1,060	707
	Kdp-e	130,560	90	0.10	100	1,180	787
	Kdp-h	273,920	100	0.10	100	2,740	1,830
	Kdp-i	200,960	40	0.10	100	804	516
VI	Kd-a	109,070	50	0.10	100	545	363
	Je	82,980	105	0.21	125	2,000	1,330
	Trc-b	823,270	110	0.10	10	9,060	6,040
	Trc-a	996,480	90	0.10	15	8,970	5,980
VII	--	--	--	0.15	500	8,670	5,780
VIII	To	213,760	25	0.15	250	1,870	1,250[6]
	K	213,760	50	0.10	500	1,070	1,870
IX	Qal-a	--	--	--	10	--	--
	Qal-b	--	--	--	1,000	--	--
	Qab	26,650	100	0.15	900	400	266
	Trc	--	--	--	5	--	--
	Trs-a	--	--	--	15	--	--
	Trs-b	--	--	--	500	--	--
	Pat	--	--	--	10	--	--
	Psa(Pg)	--	--	--	20	--	--
Total	--	--	--	--			141,951

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[1]See Figure 3.2.1-2.

[2]Geologic symbols for subregions are based on published reports.

[3]Regions I, II, III - published estimates; Regions V through IX - recoverable storage assumed to be 2/3 of groundwater in storage (New Mexico Statement, 1959).

[4]Values from the Ogallala Formation include contribution from this minor aquifer.

[5]Estimates of present pumpage in Region IV. Basin has substantial recharge; however, no new permits to pump groundwater have been issued since 1960.

[6]Estimate of measureable groundwater represents contribution from both aquifers.

Source: Texas Water Development Board (1977); New Mexico Interstate Stream Comm. and New Mexico State Engineer's Office (1975).

Source: Texas Water Development Board (1977); New Mexico Interstate Stream Comm. and New Mexico State Eng. Office (1975).

Table 3.3.2.1-2. Summary of calculations of depletion rates in Texas/New Mexico regions/subregions groundwater regions/subregions.

Region	Subregion[1] (Geologic Symbol)	Method[2]	Depletion Rate (Acre-ft per year)	Sources
I	To	A	796,000	Texas Water Development Board (1977); (see Table 2)
	Ket		([3])	
II	--	A	15,000	--
III	To	A	936,000	Texas Water Development Board (1977); (see Table 2)
	Kdp		([3])	
IV	--	--	--	--
V	To-e	A	11,000	Hudson (1976)
	To-f	A,C	24,300	Hudson (1976); Sorenson (1974)
	To-g	A	7,700	Hudson (1976)
	To-h	A	44,300	Hudson (1976)
	To-i	D	200	Cooper and Davis (1967)
	Kdp-a	A	0	Hudson and Borton (1974); Hudson (1976)
	Kdp-b	A	0	Hudson and Borton (1974); Hudson (1976)
	Kdp-c	A	16,000	Hudson (1976)
	Kdp-d	D	2,000	Sorensen (1974)
	Kdp-e	A	5,500	Hudson (1976)
	Kdp-h	A	35,600	Hudson (1976)
	Kdp-i	D	2,000	Cooper and Davis (1967)
VI	Kd-a	D	400	Griggs and Hendrickson (1951)
	Je	E,D	1,800	Trauger and Bushman (1964)
	Trc-b	B,C	0	Bureau of Reclamation (1971); Sorensen (1974)
	Trc-e	C	20,500	Sorensen (1974)
VII	--	A,B	154,000	Hudson and Borton (1974); Sorensen (1977)
VIII	To-K	C	26,400	Blaney and Hansen (1965); Sorensen (1974)
IX	Dab	A	0	Mourant and Shomaker (1970); Hudson (1976)

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[1]Geologic symbols are based on published reports.

[2]Methods of calculating depletion rate (dV/dt):

A. Rate (AFY) = (annual decline of water level) x (area) x (specific yield)
B. Rate (AFY) derived from pumpage data
C. Rate (AFY) = (amount of irrigation water minus amount of deep percolation) x (irrigated acreage)
D. Rate estimated using available data and professional judgment

[3]Depletion rate for this minor aquifer is included in the value for the Ogallala Formation.

Table 3.3.2.1-3. Annual use and depletion of groundwater in Texas.

Year	Region	Water Use (acre-ft)	Depletion (acre-ft)
1974	I	1,074,600[1]	795,980[1]
	II and III	1,934,300[2,3]	-
1980	I	975,260[1]	717,100
	II	-	15,900
	III	-	935,500
2000	I	-	545,000
	II		3,500
	II and III	1,575,500[2,3]	
	III		830,500

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[1]Value for Randall County estimated as proportion of depletion in 1980.

[2]Values reflect the sum of municipal and irrigation water uses from a summary of water use in the Canadian River Basin. Values are considered high because, in addition to the project area, Hansford, Ochiltree, Lipscomb, Hutchinson, and portions of Potter, Carson, Gray, and Hemphill counties are included in the estimate.

[3]Regions II and III are undifferentiated because they are included together in the Canadian River Basin summary.

Source: Texas Water Development Board, 1977.

Table 3.3.2.1-4. Annual use and depletion of water in New Mexico.

Year	County	Water Use (acre-ft) Surface	Water Use (acre-ft) Ground	Water Depletion (acre-ft) Surface	Water Depletion (acre-ft) Ground
1975[1]	Chaves	46,583	288,051	32,513	187,260
	Curry	1,583	314,508	1,583	172,981
	De Baca	49,727	23,371	24,067	12,892
	Harding	2,629	9,661	2,629	5,413
	Quay	81,420	37,490	42,250	20,010
	Roosevelt	11,077	243,992	11,077	134,091
	Union	10,809	90,497	7,599	50,296
		(3)		(3)	
1980[2]	Chaves	332,500		217,400	
	Curry	299,800		170,200	
	De Baca	50,800		26,300	
	Harding	18,800		12,200	
	Quay	149,900		89,900	
	Roosevelt	184,900		115,700	
	Union	132,400		70,800	
2000[2]	Chaves	332,100		219,300	
	Curry	102,600		61,700	
	De Baca	46,800		26,700	
	Harding	25,600		17,200	
	Quay	169,500		102,100	
	Roosevelt	172,900		111,500	
	Union	146,300		84,000	

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[1]Sorensen, 1977.

[2]New Mexico Interstate Stream Commission and New Mexico State Engineer Office, 1975.

[3]Combined value for surface and groundwater.

transpired, been incorporated into construction, products or crops, consumed by people or livestock, or otherwise removed from the water environment.

Because irrigation normally accounts for greater than 95 percent of withdrawals, use levels in this category are by far the most important factor in determining future demands. In some counties, irrigation is still increasing, and increased demands can be expected to cause water availability problems during the project life unless mitigating measures or moderating influences reduce competing demands or increase supply. Even where irrigation is decreasing it is unlikely that surpluses in water availability will be generated by those declines. It is more likely that production costs associated with competition for water are already reducing the viability of marginal agricultural production, thereby decreasing use levels. This problem does not preclude water use for M-X in any way, however, since M-X represents a high value use which can easily compete for water availability in a free market economy. It does suggest, however, that in many areas M-X uses may occur at the expense of irrigation or other low value uses.

Estimates of the allowable development of groundwater in the project area are presented in Table 3.3.2.1-5. For those subregions where value for "life of aquifer" is presented, mining (overdraft) of the groundwater reservoir (aquifer) is permitted by state laws. The life of the aquifer, therefore, corresponds to an estimate of the additional years that the groundwater reservoir can sustain present uses.

The "allowable additional development" assumes a 40-year life of the aquifer. It is the annual use, in addition to existing uses, that can be developed from the groundwater reservoir such that the reservoir would be depleted in 40 years. This additional groundwater development is assumed to be consumptive use, which probably would result from municipal and industrial use of the water for the proposed M-X project. Where the "life of aquifer" is less than 40 years, no additional development of the aquifer is assumed. The subregions with less than a 40-year "life of aquifer" are judged to have a severe problem of groundwater overdraft. Forty years is the life of the aquifer generally assigned by the New Mexico state engineer to declared underground water basins in which overdraft is permitted.

It should be noted that the State of New Mexico correctly pointed out that although a 40-year aquifer life for administrative purposes does have precedent in Declared Underground Water Basins in which overdraft (mining of water) is permitted, the use of aquifer life is inappropriate for areas in which the aquifers are stream-connected as in the Roswell Basin. This is true because the streams represent constant sources of recharge to the aquifers and/or periods of heavy pumping. In New Mexico this situation is the case in major portions of Ground Water Regions IV and IX, and consequently no values for life of the aquifer are presented for those regions in Table 3.3.2.1-5.

The State of New Mexico also commented that Table 3.3.2.1-5 shows "aquifer life" by large geographic regions, and therefore presents an "average aquifer life" for the region. Subareas within the regions may have considerably different projected "aquifer lives." For example, in Region VII the aquifer life is shown as 37 years and includes the Clovis area and the Portales underground water basin. But there are places within a few miles of Clovis with a projected aquifer life of as little as six years, and areas in the Portales Basin where it is zero.

Table 3.3.2.1-5. Availability of groundwater in the Texas/New Mexico study area. (Page 1 of 2)

Region[1]	Subregion[2]	Recoverable Groundwater In Storage (10^3 acre-feet)	Depletion Rate (10^3 AFY)	Life of Aquifer[3] (years)	Allowable Development[4] (10^3 AFY)
I	To Ket^7	28,100	796	35	0
II	--	490	15.9	31	0
III	To Kdp^7	72,100	936	77	866
IV	shallow artesian	([6])	--	--	0
V	To^3	215	11.0	19	0
	To^4	4,270	24.3	175	82.4
	To^5	687	7.7	89	9.5
	To^6	609	44.3	14	0
	To^7	103	0.2	515	2.4
	Kdp^1	4,680	0.0	--	117
	Kdp^2	2,560	0.0	--	64.0
	Kdp	1,110	16.0	69	11.7
	Kdp	707	2.0	353	15.7
	Jdo^3	787	5.5	143	14.2
	Kdp^6	1,830	35.6	51	10.2
	Kdp^7	536	2.0	268	11.4
VI	Kd^1	363	0.4	907	8.7
	Je	1,330	1.8	739	31.4
	Trc^2	6,040	0.0	--	151
	Trc,s	5,980	20.5	292	129

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Table 3.3.2.1-5. Availability of groundwater in the Texas/New Mexico study area. (Page 2 of 2)

Region[1]	Subregion[2]	Recoverable Groundwater In Storage (10^3 acre-feet)	Depletion Rate (10^3 AFY)	Life of Aquifer[3] (years)	Allowable Development[4] (10^3 AFY)
VII		5,780	154	37	0[7]
VIII	To K[5]	1,250	26.4	47	4.8
IX	Qab	266	0.0	--	0[8]

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[1]Regions shown on Figure 3.3.1.3-2.

[2]Geologic symbols for subregions provided on Figure 3.3.1.3-2.

[3]Life of Aquifer = $\frac{\text{Recoverable Groundwater in Storage.}}{\text{Depletion Rate}}$

[4]Allowable Additional Development (Q) assumes a 40-yr life of the aquifer:

$$Q = \frac{\text{Recoverable Groundwater in Storage}}{40} - \text{Depletion Rate.}$$

[5]Values of recoverable storage and depletion rate include contributions from both aquifers.

[6]Pumpage in Roswell Basin limited by State Engineer to present amount: approximately 104,000 AFY for shallow aquifer and 184,000 AFY for artesian aquifer in Region IV.

[7]Additional development in the Portales Underground Water Basin is regulated by the New Mexico State Engineer.

[8]Subregion lies within Fort Sumner Underground Water Basin. Additional development probably not allowed unless surface rights are retired.

An interpretation of the estimates of physical availability of groundwater is as follows. For subregions in which "allowable additional development" is non-zero, additional groundwater development can take place. The relative size of that additional development is indicated by the values in Table 3.3.2.1-5. For subregions in which "allowable additional development" is zero, existing uses of groundwater would have to be retired in order to use groundwater for other purposes.

Reliance on Table 3.3.2.1-5 to predict the availability of groundwater must be qualified. First, in New Mexico, the state engineer may administer use of groundwater by declaration of an underground water basin. Parts of Regions IV, VII, and IX lie within such declared basins and are essentially closed to additional groundwater development. In the Portales underground water basin, use of relatively large quantities of groundwater would require the purchase of existing groundwater rights. In the Fort Sumner and Roswell underground water basins, use of groundwater possibly could require the purchase of both groundwater and surface water rights. The dependability of groundwater rights in basins tributary to the Pecos River are in question because of the ongoing suit over the Pecos River Compact. In addition, the New Mexico state engineer may declare a new underground water basin in the project area if he feels management controls of groundwater use are necessary.

Secondly, in the Texas part of the project area, most of the land and, consequently, the water rights, are owned by individuals. Purchase or lease of the land and/or water rights would be required to develop the groundwater for municipal and industrial use for the proposed project M-X. In areas under the jurisdiction of underground water conservation districts, rules established by the respective districts regarding well spacing would have to be followed.

Thirdly, the values presented in Table 3.3.2.1-5 are for planning purposes only and should be used cautiously, especially in subregions where extensive development of groundwater has not taken place. In these relatively undeveloped subregions, published hydrologic data probably are not sufficient to reliably estimate the quantity of recoverable groundwater, potential well yields and other design factors, and the economics of obtaining a groundwater supply. In addition, the foregoing analysis has not considered uncertainties involved in the acquisition of land and/or water rights.

Detailed summaries of the hydrologic conditions in the groundwater regions are presented in Section 3.2.4 of ETR-12.

Surface Water Resources (3.3.2.1.2)

The project area lies within parts of three major surface water drainage basins: (1) Arkansas-Red White River Basins, (2) Texas Gulf Basins, and (3) Pecos River Basins (Figure 3.3.2.1-3). The principal surface water resources in the project area are the Canadian River in New Mexico and Texas, and the Pecos River in New Mexico (Figure 3.3.2.1-3). The locations of major and minor water courses, surface water reservoirs, and gauging stations for both stream flow and water quality records for the project area are summarized in Figure 3.3.2.1-3. The major surface water projects (reservoirs) that are presently operating and drainage areas that are regulated by interstate compacts are shown on Figure 3.3.2.1-3.

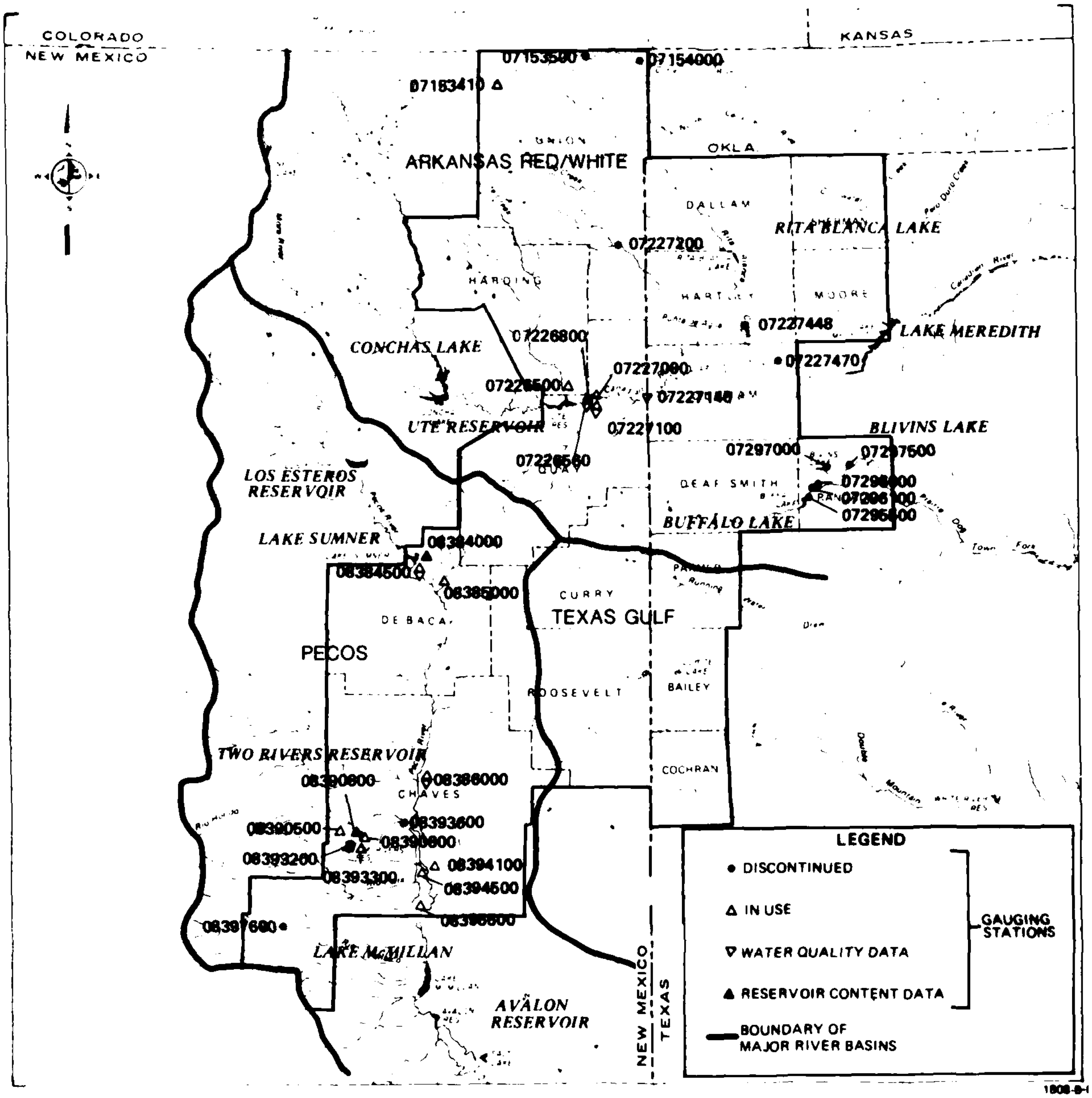

Figure 3.3.2.1-3. Major drainage basins and stream gauging stations.

The Canadian River flows through Quay County, New Mexico, and Oldham and Moore counties, Texas. Stream flow is regulated principally by the Ute Reservoir in New Mexico and Lake Meredith in Texas. Lake Meredith supplies water for municipal and industrial uses in 11 west Texas cities. The contracted amount of this water is 103,000 AFY. Water from Ute Reservoir is available for municipal and industrial uses but is largely unsold at present. Ute Reservoir has been designed to comply with the provisions of the Canadian River Compact, which allows a maximum storage capacity of 200,000 acre-feet between Conchas Dam and the New Mexico/Texas state line. At present, the storage of Ute Reservoir is about 90,000 acre-feet. The reliable yield of Ute Reservoir is estimated at approximately 10-15,000 acre-feet per year. However, the water is used only for municipal purposes at a state park and for gravel washing.

At present, Texas essentially has free and unrestricted use of waters in the Canadian River Basin in Texas, excluding the North Canadian River. Lake Meredith effectively controls all of the developable surface water resources in Texas in accordance with provisions of the Compact. Water from Lake Meredith is sold to 11 cities for municipal and industrial uses. The contracted amount of water from the reservoir, 103,000 AFY, is assumed to be the reliable yield. However, the quantity of water released to the cities in the last five years has averaged about 70,000 AFY (U. S. Water and Power Resources Service, 1980).

The Pecos River flows through De Baca and Chaves Counties, New Mexico. Stream flow is regulated principally by Los Esteros Reservoir, north of the project area, and by Lake Sumner. Water uses (both ground and surface water) must comply with provisions of the Pecos River Compact, which state that upstream use of the Pecos River shall not diminish the flow entering Texas below the amount available under 1947 conditions. The Pecos River Compact is being adjudicated at present by the U.S. Supreme Court in a suit between New Mexico and Texas.

The average annual discharge of the Pecos River in the project area is approximately 150,000 AFY. Losses of streamflow take place in the reach of the Pecos River between Sumner Dam and Acme. The river gains base flow from seepage of ground water in the reach between Acme and Lake Arthur. Water in the Pecos River in the project area is slightly saline. The water is probably adequate for irrigation but unsuitable for municipal uses. In the reach between Sumner Dam and Acme, water quality shows a marked degradation.

Virtually all surface water in the project area is appropriated and is being used beneficially within the terms of international treaties, interstate compacts, court decrees and state laws. A major exception is water in Ute Reservoir, which has been appropriated by the New Mexico Interstate Stream Commission. This water would be available under contract to the Interstate Stream Commission. Waters available from the Ute Reservoir is estimated to be 10,000 to 15,000 AFY.

Other major surface water resources in the project area would be available only by purchase of water rights or lease of water from existing users. Development of these surface water resources for M-X would require retiring existing uses of the water. Water in Lake Meredith in Moore County, Texas, must be purchased from the Canadian River Municipal Water Authority. Rights to water flowing or in storage along the Pecos River in New Mexico would have to be purchased or leased from irrigation districts. Without prior treatment, the quality of water in parts of

the Pecos River may not be satisfactory for the purpose of the proposed M-X project.

More detailed descriptions of the general hydrology of each of the basins may be found in ETR-12.

Administration of Water Rights (3.3.2.1.3)

New Mexico Systems of Water Appropriations

All surface water and groundwater in New Mexico belongs to the public and is subject to appropriation for beneficial use, which is the basis, measure, and limit to the right to use water. Priority is given to the oldest appropriation. The administration of water rights in New Mexico is under the jurisdiction of the state engineer as set forth in provisions of the constitution and statutes of the state, by adjudications of the courts, and by terms of interstate compacts.

Surface water throughout the state of New Mexico is subject to regulation by the state engineer under the 1907 water code, and groundwater in certain areas of the state is also subject to control by the state engineer under the groundwater code enacted in 1931. Surface and groundwater statutes are found in Chapter 72, New Mexico Statutes Annotated 1978 (NMSA 1978).The authority of the state engineer exists only in so-called "declared undergound water basins," basins declared by the state engineer to have reasonably ascertainable boundaries and for which management controls are necessary. The state engineer may declare an undergound water basin without obtaining judicial approval. At the present time, there are 27 declared underground water basins in New Mexico, encompassing approximately 59 percent of the land area of the state.

Four concepts of New Mexico water law are important to consider in the selection of an available source of water for M-X. First, water rights are considered to be property rights; as such they may be transferred, sold, or leased. Second, water rights are not necessarily appurtenant to the land from which the water is diverted or extracted. One may own a water right that permits pumping of water from one groundwater basin and applying the water to beneficial use in another basin.

Third, the mining (overdrafting) of groundwater basins is permitted in New Mexico. The state engineer decides whether the groundwater in a particular basin will be mined. In a mined basin, the state engineer determines the rate at which the groundwater reservoir will be depleted. The lowering of water levels in a mined basin caused by the pumping of groundwater by relatively junior appropriators, together with the resulting increase in pumping costs and decrease in well yields, does not necessarily constitute an impairment of the rights of relatively senior appropriators. Finally, New Mexico water law does not establish a priority of uses for water, so that use of water for irrigation is as appropriate a beneficial use as is the use of water for municipal and industrial purposes.

Status of Appropriations

All or part of five declared underground water basins are present in the project area. Four of these, the Canadian River, Fort Sumner, Penasco and Roswell

Underground Water Basins, are classified as stream connected in which groundwater extraction may result in a decrease in the discharge of surface streams in the basin. No new permits to appropriate groundwater in these basins are allowed by the state engineer unless the immediate and potential effects of this appropriation are offset by the retirement of existing surface water rights.

In the Portales underground water basin, mining of groundwater is permitted at rates set by the state engineer. This basin is probably fully appropriated except for about 5,000 acre-ft per year in the sand hills in the eastern part of the basin (Jim Wright, New Mexico State Engineer Office, 1979, personal communication).

Outside of these declared basins in the project area, the drilling and pumping of water wells is unregulated. However, it is reasonable to assume that the state engineer may declare a new basin in an area where relatively large new uses of groundwater are proposed.

Surface water in the project area is fully appropriated except in the Arkansas-Red/White River Basins. About 10,000 to 15,000 acre-ft per year from the Dry Cimarron River may be available for appropriation. In the Canadian River Basin, Ute Reservoir has been designed to hold 200,000 acre-ft of conservation storage, the maximum allotted under the Canadian River Compact, when spillway gates are installed. These gates have not been built yet, although bonds for most of the construction costs have been authorized by the New Mexico Legislature. The present conservation storage capacity of Ute Reservoir is 90,000 acre-ft of unappropriated rights. It may be possible to divert streamflow in Revuelto Creek (approximately 35,000 acre-ft per year) until such time as spillway gates on Ute Dam have been installed (Slingerland, 1980).

The Pecos River in New Mexico is generally believed to be overappropriated. The Carlsbad Irrigation District, south of the project area, has the oldest priority (1887 and 1888) for large quantities of direct flow in the river. The District also has the right to store 300,000 acre-ft per year in Los Esteros Reservoir and Lake Sumner, with a priority date of 1906. By stipulation, the Fort Sumner Irrigation District in northern De Baca County has the right to divert approximately 35,000 acre-ft/year at a rate not to exceed 100 cu ft/second, or the flow of the Pecos River, whichever is smaller. This water is released from Lake Sumner. In the event of a water right transfer, the amount of water that could be changed would be the consumptive use from the water right acreage proposed to be moved.

Other uses of water from the Pecos River in the project area either are small or have relatively junior priorities. Included in this latter category are rights to pump groundwater in the Fort Sumner and Roswell underground water basins. The U.S. Supreme Court, in the suit between Texas and New Mexico regarding the Pecos River Compact, has defined the provision of the Compact regarding 1947 conditions. New Mexico, in maintaining the flow to Texas that was occurring in 1947, must account for river losses due to development of groundwater in the Roswell Basin as of 1947. The full effect of depletion in the surface flow of the Pecos River due to pumping since 1947 may not yet have occurred. When rights in the Pecos River are adjudicated as a result of this suit, many groundwater rights in the Fort Sumner and Roswell areas may have to be retired (Slingerland, 1980).

Texas Systems of Water Appropriation

Surface water within a defined watercourse in Texas is public water and is subject to appropriation for beneficial use. Beneficial use is the basis, measure, and limit of the right to use water, and priority in date of appropriation gives the better right. Besides priority in date of appropriation, the following priorities for types of beneficial uses are also applicable: (1) domestic and municipal; (2) industrial; (3) irrigation; (4) mining and recovery of minerals; (5) hydroelectric power; (6) navigation; (7) recreation and pleasure; and (8) other beneficial uses. Whether priority by date of priority by use takes precedence has not been decided by Texas courts. Surface water rights are adminstered by the Texas Water Commission of the Texas Department of Water Resources. An adjudication of water rights in the Canadian River Basin in the project area is underway, and a report of water-rights claims has been issued (Water Rights Adjudication Section, 1980).

Groundwater in Texas belongs to the individual landowner and is, therefore a private right. Texas courts have followed unequivocally the "English" or "common law" rule that the landowner has a right to take for use or sale all the water he can capture from beneath his land. Owners of land overlying defined groundwater reservoirs (i.e., the Ogallala aquifer) may voluntarily adopt well regulation through mutual association in groundwater conservation districts.

Three groundwater conservation districts have been created in the project area. Only two of those districts, North Plains Ground Water Conservation District No. 2 and High Plains Underground Water Conservation District No. 1., are active. These districts are headquartered in Dumas and Lubbock, respectively, and have jurisdiction in part of the project area. The principal rules, established by the districts that control use of groundwater, are the required minimal spacings for wells. Spacing between wells depends on the design discharge of the well, as measured by the inside diameter of the pump column. For example, in the North Plains Ground Water Conservation District No. 2, a proposed well with a ten inch or larger pump must be spaced at least 500 yds from the nearest well. Other wells of the districts prohibit the waste and pollution of water.

Status of Appropriations

Surface water in the project area is considered by state authorities to be fully appropriated. Existing surface water impoundments control most of the developable surface water supplies. In the Canadian River Basin, the Canadian River Municipal Water Authority has rights to use approximately 150,000 acre-ft per year from Lake Meridith for municipal and industrial purposes. Their permit is subject to the provisions of the Canadian River Compact, which will not be enforced until Oklahoma builds more reservoirs for conservation storage. In the Red River Basin there are water-rights permits for both Bivins and Buffalo Lakes, although spring-flow that once supplied Buffalo Lake has dried up (Settemeyer, 1980). In the Brazos and Colorado River Basins, surface runoff is not sufficient to administer under a system of water rights (Haisler, 1980).

East of the project area in Hansford County, Texas, the Palo Duro River Authority of Texas has rights to approximately 10,000 acre-ft of water per year in Palo Duro Creek for municipal use. A reservoir to store this water has been permitted but has not been constructed (Water Rights Adjudication Section, 1980).

Erosion (3.3.2.2)

The general processes by which wind and water detach and transport the soil are the same in Texas/New Mexico DDA as in Nevada/Utah DDA. For more detailed discussions of erosion, see ETR-34, Wind Erosion and ETR-11, Geology and Mining, Chapter 5.

The Texas/New Mexico study area consists largely of broad, level to nearly level uplands. The flat landscape provides little resistence to the wind. High wind velocities are common, especially in late winter and spring. Although the inherent wind erodibility of some soils in the Texas/New Mexico DDA is low due to soil texture, the erodibility of most soils is moderate to high. However, water erosion can be comparable to, or greater than that in Nevada/Utah due to higher precipitation.

The Texas/New Mexico study area can be divided geographically into four regions: the south, the central, the Canadian River Breaks, and the north portions.

1. The southern portion of the Texas/New Mexico study area is dominated by soils with a high sand content. Most upland soils in the area have formed on wind-blown deposits comprised of fine sands.

2. The central portion of the study area is dominated by fine texture soils. In Quay county, New Mexico, for example, the loam phase dominates the Amarillo Series. However, Pullman loam is the principal upland soil throughout much of this area. Clay content increases eastward so that throughout Parmer, Castro, Swisher, Deaf Smith, Randall counties and southern Oldham County, Texas, clay loams, primarily of the Pullman and Olton Series, dominate. Unlike the situation to the south, where several textures occupy major shares of the landscape, in the central portion, one textural class (clay loam) overwhelmingly dominates the uplands. Most of these soils formed from wind-blown deposits.

3. Soil development in the Canadian River Breaks has created highly complex soil distribution patterns due to the rugged terrain. The Canadian River Breaks are not included in the DDA suitability areas.

4. Soils north of the Canadian River tend to have higher sand contents than soils in the central portion of the study area. Medium loams, fine textured soils dominate this portion of the study area except in the northeast where fine textured soils dominate.

Air Quality (3.3.2.3)

<u>Meteorology</u>

The climate of the Texas/New Mexico study area, semi-arid with dry winters, is transitional between the desert to the west and the humid coastal regions to the east. Precipitation varies widely with respect to location and amount throughout the year. Flash flooding is common. Tornadoes may occur from May through August. Dust storms occur frequently in the spring and are associated with frontal passages. This area has the highest incidence of naturally caused windblown dust in the United States (Table 3.3.2.3-1). The study area has good vertical mixing, high wind speeds and small potential for high concentrations of gaseous pollutants (Table 3.3.2.3-2).

Table 3.3.2.3-1. Monthly percent frequency of dust observations in the Texas/New Mexico regions.

Month	Percent Frequency[1]			
	Clovis	Clayton	Amarillo	Lubbock
January	1.400	2.400	0.700	2.900
February	3.100	0.620	2.100	4.500
March	6.000	3.348	3.400	7.700
April	5.500	1.541	3.200	7.600
May	2.700	0.427	1.100	4.500
June	1.500	0.284	0.700	2.800
July	0.500	0.061	0.300	0.500
August	0.300	0.061	0.100	0.200
September	0.700	0.346	0.400	0.500
October	0.600	0.065	0.400	0.500
November	1.000	0.068	0.600	1.400
December	2.000	0.304	1.300	3.400
Annual Average	2.100	0.610	1.200	3.100

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[1] The percentage of hourly weather observations in which dust is reported as a restriction to visibility.

Source: Orgill and Sehmel, 1975.

Table 3.3.2.3-2. Wind speeds and mixing heights for stations in Texas/New Mexico.

Station	Time	Winter		Spring		Summer		Autumn		Annual	
		HT[1]	U[2]	HT	U	HT	U	HT	U	HT	U
Albuquerque, NM	Morning	391	4.0	553	4.5	582	3.7	414	3.5	485	4.9
	Afternoon	1,464	5.8	3,452	8.9	3,941	6.0	2,295	5.5	2,788	6.5
Amarillo, TX	Morning	273	6.9	337	8.1	379	7.4	323	6.8	328	7.3
	Afternoon	1,171	8.5	2,507	10.1	2,520	7.4	1,693	7.6	1,973	8.4
Midland, TX	Morning	290	5.7	429	7.5	606	7.2	419	6.0	436	6.6
	Afternoon	1,276	7.8	2,449	9.0	2,744	6.7	1,887	6.7	2,089	7.5

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[1]Mixing height given in meters.

[2]Wind speeds are averaged through the mixed layer and are in units of meters per second.

Source: U.S. Department of Commerce, 1965. "Climatography of the United States, decennial census of the United States climate--climatic summary of the United States--supplement for 1951 through 1960," No. 86-36 (Texas), No. 86-25 (New Mexico), Washington, D.C.

Air Quality

The federal, Texas, and New Mexico ambient air quality standards are presented in Table 3.3.2.3-3. In addition to the federal standards, Texas has adopted more strict short-term particulate standards.

The New Mexico particulate standard is identical to the secondary federal standard. As for gaseous pollutants, the Texas and federal standards are identical; the New Mexico standards are stricter than the corresponding federal standards. The federal primary annual and 24-hour particulate standards have been exceeded at several locations in the study area: e.g., Lubbock, Texas, and Hobbs and Clovis, New Mexico. Sulfur dioxide, ozone, and carbon monoxide levels remain below standards.

Mandatory Class I areas (minimal degradation permitted) located in the basing area are Carlsbad Caverns, White Mountain Wilderness Area, Wheeler Peak Wilderness Area, Salt Creek Wilderness Area, and Pecos Wilderness Area. The air quality study area boundary and Class I areas are shown in Figure 3.3.2.3-1.

One Class II area (some degradation permitted) in the basing area, the Capulin Mountain National Monument in New Mexico, has been recommended for consideration for redesignation to Class I status.

Mining and Geology (3.3.2.4)

Seismicity (3.3.2.4.1)

No active earthquake region is in the study area. Only minor damage can be expected to occur from distant earthquakes.

Minerals (3.3.2.4.2)

The major resources are oil, natural gas, sand and gravel, natural carbon dioxide, lime, and scoria. Potential deposits of copper, gold, uranium, potash, salt, high calcium limestone, vanadium, and diatomaceous earth have been identified, but no production exists.

Sherman and Cochran counties in Texas, and Roosevelt and Chaves counties in New Mexico contain giant oil or natural gas fields and have been continuously produced for many years. Several counties in eastern New Mexico remain largely unexplored for oil and gas, mostly because they do not contain favorable source and reservoir rocks. Figure 3.3.2.4-1 indicates areas of oil and gas and uranium potential. More detail on oil and gas resources is found in ETR-11, Chapters 3 and 7.

Table 3.3.2.4-1 presents the value of mineral production in the study area by county.

Vegetation and Soils (3.3.2.5)

Much of the study area has been previously cleared for agriculture. Over 50 percent of the Texas counties in the study area is in cropland; the percentage in the New Mexico portion (except Curry County) is much smaller.

Table 3.3.2.3-3. Summary of National Ambient Air Quality Standards (NAAQS) and Texas/New Mexico Ambient Air Quality Standards.

Pollutant	Averaging Time	NAAQS Primary	NAAQS Secondary	Texas Standards	New Mexico Standards
Total Suspended Particulate Matter	Annual (Geometric Mean)	75 $\mu g/m^3$	60 $\mu g/m^3$[1]	Same as NAAQS	60 $\mu g/m^3$
Total Suspended Particulate Matter	24-hour[2]	260 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$
Total Suspended Particulate Matter	1-hour[3]	--	--	400 $\mu g/m^3$	N/A
Total Suspended Particulate Matter	3-hour[3]	--	--	200 $\mu g/m^3$	N/A
Total Suspended Particulate Matter	5-hour[3]	--	--	100 $\mu g/m^3$	N/A
Lead	Quarterly (Arithmetic Mean)	1.5 $\mu g/m^3$	--	Same as NAAQS	Same as NAAQS

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[1]Secondary annual NAAQS TSP standard (60 $\mu g/m^3$) is a guide for assessing state implementation plans.

[2]Not to be exceeded more than once per year.

[3]Not to be exceeded any time by any single major stationary source or group of sources located on contiguous property.

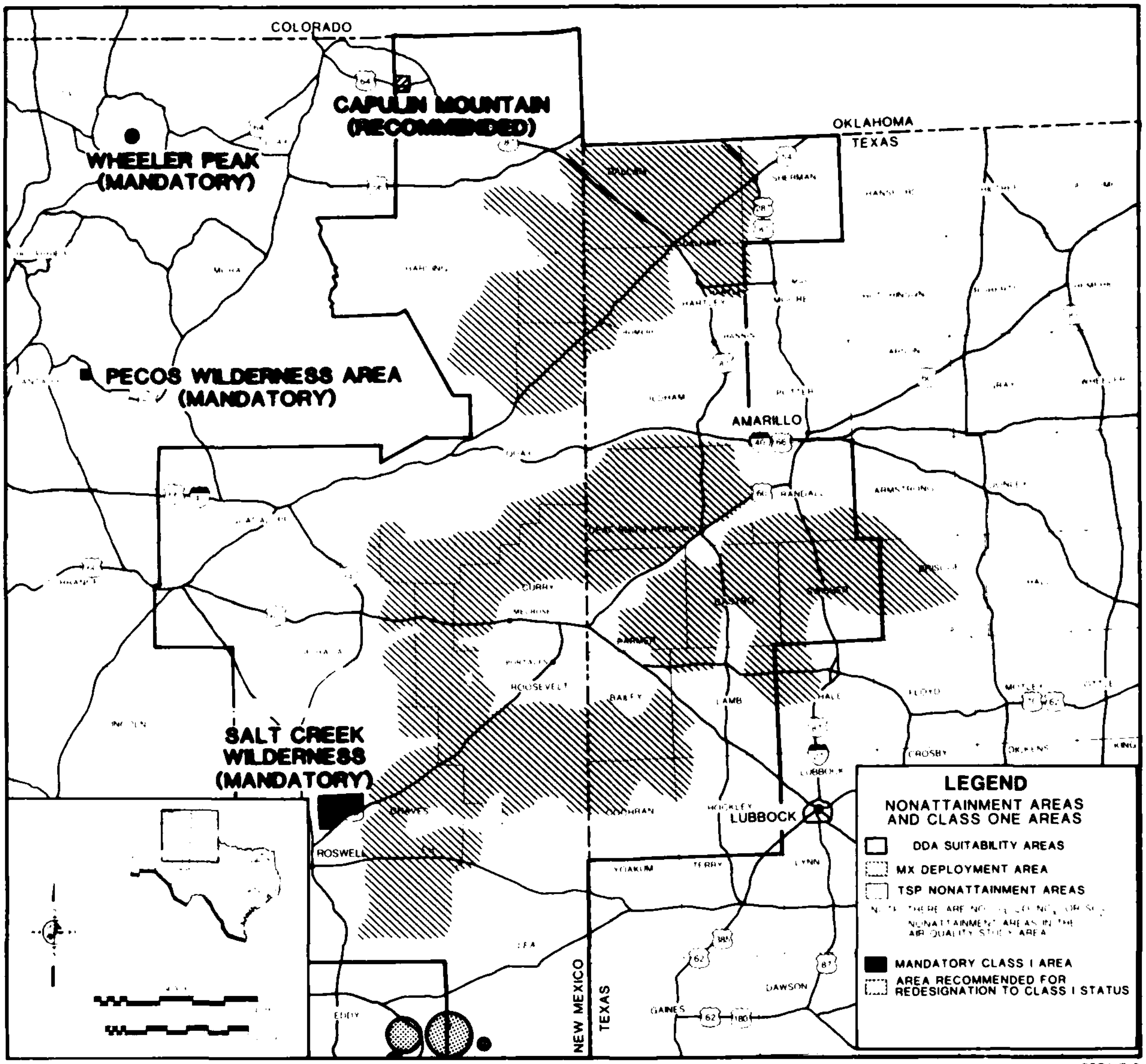

Figure 3.3.2.3-1. Nonattainment and Class I areas in the Texas/New Mexico study area.

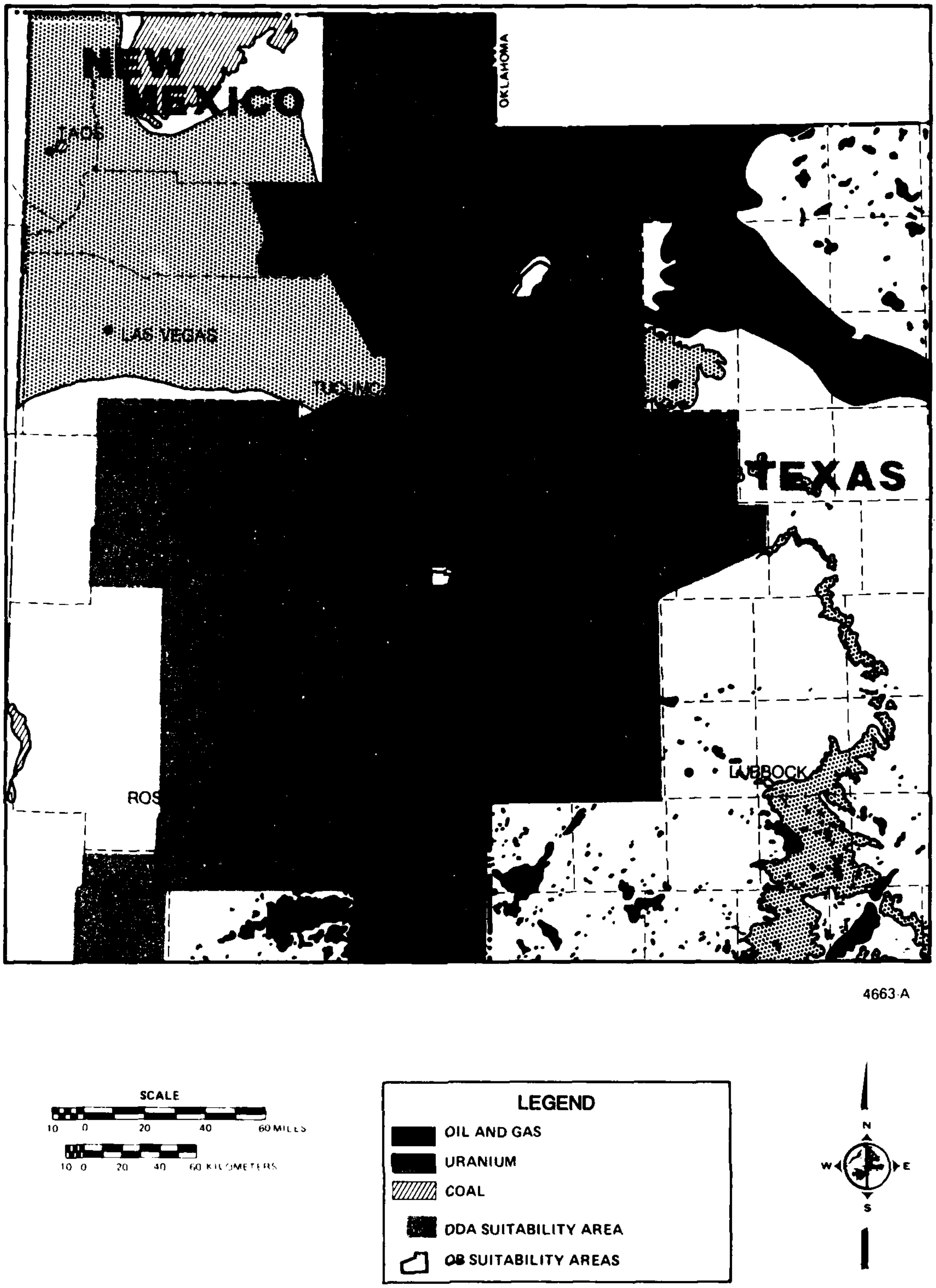

Figure 3.3.2.4-1. Oil, gas, and potential uranium occurence in the Texas/New Mexico study area.

Table 3.3.2.4-1. Value of mineral productions in Texas/New Mexico by county within study area.

County	Value (1976)	Minerals	Percent of State Total (1976)	Value (1979)
Texas			($18.1 Billion)	
Bailey	W	Stone		
Cochran	$169,270,000	Petroleum, Natural Gas	0.9	
Dallam	W	Natural Gas		
Oldham	$ 4,496,000	Petroleum, Natural Gas, Sand and Gravel	0.02	
Parmer	W	Stone		
Sherman	$ 42,439,000	Petroleum, Natural Gas	0.2	
Hartley	W	Natural Gas		
Deaf Smith	W	Limestone (Caliche)		
New Mexico			($2.5 Billion)	
Chaves	$ 20,387,000	Petroleum, Natural Gas, Sand and Gravel, Stone	0.8	$37,145,000
Curry	W	Sand and Gravel		
DeBaca	W	Sand and Gravel		
Harding	$ 80,000	Carbon Dioxide	0.003	
Quay	W	Sand and Gravel, Stone		
Roosevelt	$ 19,048,000	Petroleum, Natural Gas, Stone	0.75	$30,500,000

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W - Figures withheld to prevent disclosure of single company production; state totals do not include county withheld values.

Source: U.S. Bureau of Mines, Minerals Yearbook, 1976.

The undisturbed natural vegetation of the study area is composed of short-grass prairie or rolling hills with sandy soils and small inclusions of clayey soils and supports fast-growing prairie grasses, including blue grama grassland and mixed grama grassland vegetation types, which have moderately fast recovery rates. Figure 3.3.2.5-1 shows the historical distribution of native vegetation in the study area. Uplands, canyons, and riparian areas are dominated by woodlands with large shrubs and small trees. Characteristics of natural vegetation types are summarized in Table 3.2.2.5-1, and presented in greater detail in ETR-14, "Native Vegetation."

Abundance, sensitivity to impacts, and data quality are analyzed by county for three vegetation types: shinnery oak/sand sage, wetland/riparian, and upland breaks. Occurrence and impact sensitivity are discussed briefly in Section 4.3.1.5.9 and in greater detail in Section 2 of ETR-14, "Native Vegetation."

The study area has two major soil types, Alfisols and Mollisols. Found on gently undulating upland surfaces, both are alkaline, generally fertile, and suitable for irrigated crops. Aridisols occur in only small regions. Figure 3.3.2.5-2 shows soil groups in the study area. In general, erosion potential from wind is high.

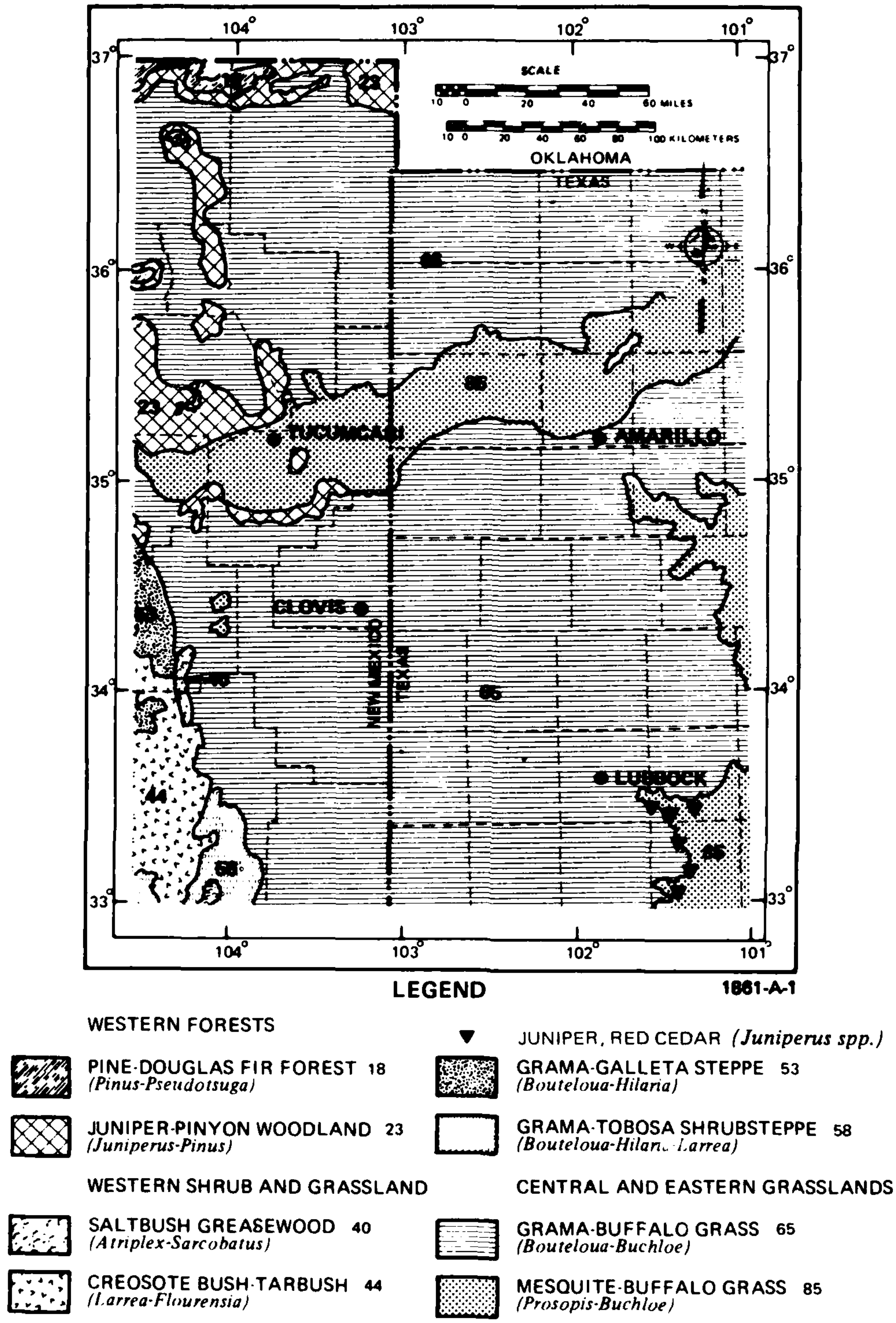
Wildlife (3.3.2.6)

Non-game Species (3.3.2.6.1)

The Texas/New Mexico area contains wildlife species that are typical of the High Plains, although most species are distributed widely throughout the western United States. Species diversity is low in most habitat types because of the low vegetation structural diversity. Most species of amphibians are associated with riparian habitats and playa lakes. Reptiles are found in all terrestrial habitat types, but are most abundant in scrub/grasslands and canyon lands. Amphibians and reptiles found in the M-X areas are listed in Table 3.3.2.6-1. Nocturnal rodents are the most abundant members of the small mammal community. Mammals found in the M-X area are listed in Table 3.3.2.6-2. Birds are the most mobile inhabitants of the area and their dispersion and abundance change seasonally. Birds species diversity is highest in riparian and canyon habitat, those areas with greatest vegetation structural diversity. Birds found in the M-X area are listed in Table 3.3.2.6-3.

Game Animals (3.3.2.6.2)

Four species of big game in the Texas/New Mexico area include mule deer (Figure 3.3.2.6-1), white-tailed deer (Figure 3.3.2.6-1), pronghorn (Figures 3.3.2.6-2) and, at the edge of the area, barbary sheep (aoudad) (Figure 3.3.2.6-3). Pronghorn are the most abundant game animal in the area, although their range is restricted to the shortgrass prairies. Nine species of upland game in the area include eastern and desert cottontails, bobwhite and scaled quail (Figure 3.3.2.6-4), ring-necked pheasant and turkey (Figure 3.3.2.6-5), lesser prairie chicken (Figure 3.3.2.6-6), sandhill crane and mourning dove. Scaled quail are common in rangeland; ring-neck pheasant and bobwhite are common in cropland. Mourning doves are widespread and abundant throughout the area. The most commonly trapped furbearers in the area are coyote, fox, skunk, ringtail, and bobcat. Playa lakes provide critical winter habitat for migrating waterfowl and are found throughout the M-X area (Figure 3.3.2.6-7). Several national wildlife refuges are located in the region and provide high quality habitat for migratory and breeding waterfowl.



SOURCE: KUCHLER, 1975

Figure 3.3.2.5-1. Simplified vegetation map of the Texas/New Mexico study area.

Table 3.3.2.5-1. Major vegetation types in the Texas/New Mexico study area.

Type	General Location	Composition	Source of Present Disturbance
Blue grama grassland	Clay-clay loam soils, north-northeast portions	Blue grama, buffalo grass	Agriculture, grazing
Mixed grama grassland	Silt loam-sandy loam, most of high plains	Blue grama, side-oats grama, purple three-awn	Agriculture, grazing
Bluestem grassland	Sandy soils	Little bluestem, side-oats grama, sand bluestem, sand sage, shinnery oak	Grazing, agriculture, oil fields
Mesquite grassland	Overgrazed grassland	Honey mesquite, blue grama, little bluestem	Overgrazing, ORVs
Sand dune vegetation	Sand	Shinnery oak, sand sage	Grazing, hunting, ORVs
Desert grassland	Western edge, dry high plains	Black grama, tobosa grass, fluff grass, soap-tree yucca	Grazing, hunting, ORVs
Chihuahuan Desert scrub	Southern edge, high plains	Creosote bush, black grama, bush muhly	Grazing, hunting, ORVs
Upland and canyon break vegetation	Gravelly loam, rolling to steep slopes	Juniper, mesquite, oak	Grazing, hunting, ORVs
Riparian woodland	Stream valleys	Cottonwood, hackberry, willows, mesquite, tamarisk	Hunting, grazing, camping, ORVs
Floodplain vegetation	Salty floodplains	Alkali saccaton, giant dropseed	Grazing, ORVs
Playa lake wetland	Playa lakes on high plains, clay soils	Buffalo grass, wheatgrass, cattail, bullrush, willow	Agriculture, grazing

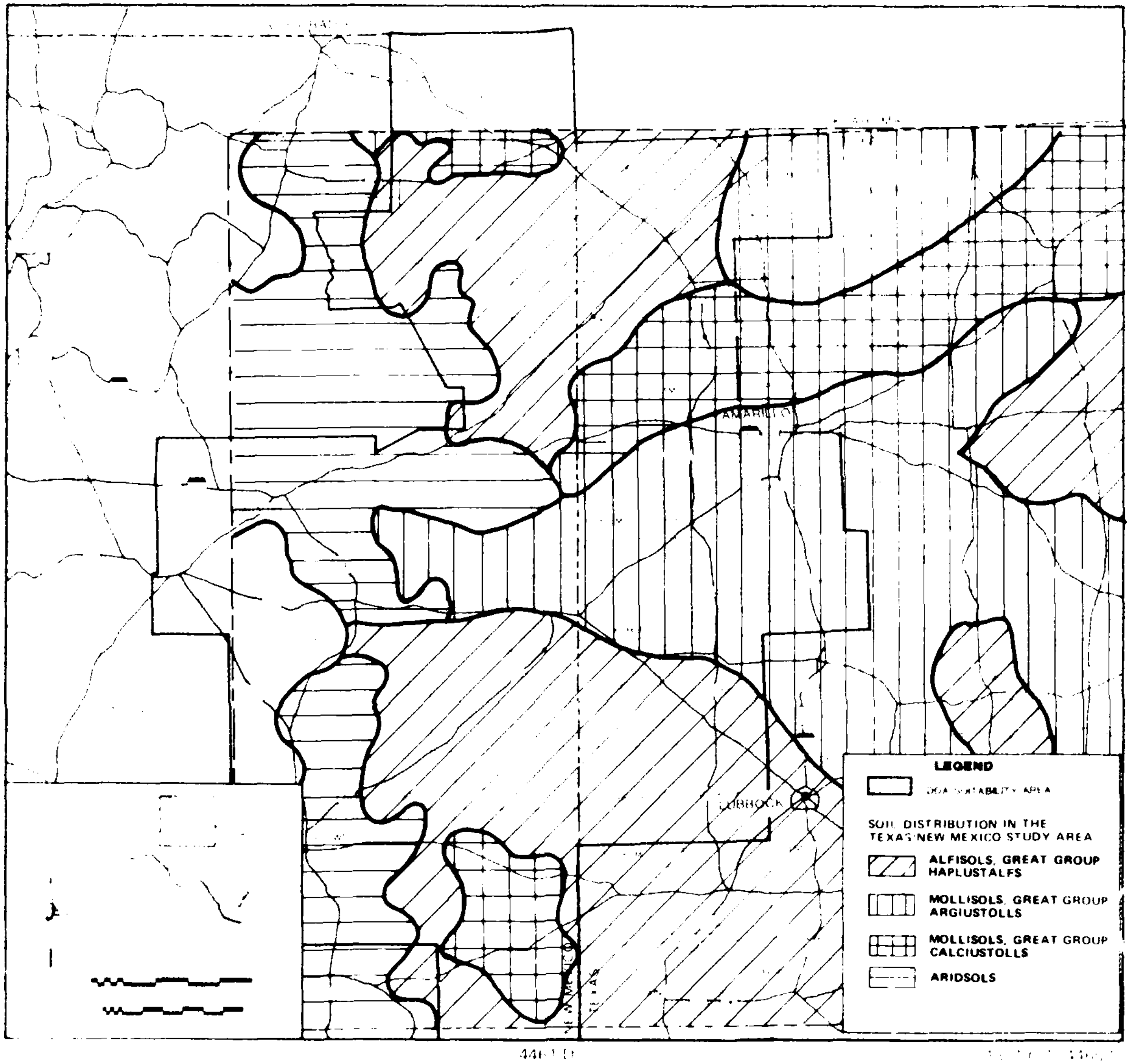


Figure 3.3.2.5-2. Soil types of the Texas/New Mexico study area.

Table 3.3.2.6-1. Amphibians and reptiles of the Texas/New Mexico M-X study area (Page 1 of 2).

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Aquatic and Shoreline	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Amphibians								
Salamanders, Frogs and Toads								
Tiger salamander	Ambystoma tigrinum	C	T	X	X			
Plains spadefoot	Scaphiopus bombifrons	C	T	X	X	X	X	X
Western spadefoot	S. hammondi	C	T	X	X		X	
Woodhouse toad	Bufo woodhousei	C	T	X	X	X	X	X
Great Plains toad	B. cognatus	C	T	X			X	
Green toad	B. debilis	C	T	X			X	
Red-spotted toad	B. punctatus	C	T	X		X	X	
Bullfrog	Rana catesbeiana	C	T	X	X			
Plains leopard frog	R. blairi	C	T	X	X			
Reptiles								
Turtles								
Snapping turtle	Chelydra serpentina	C	T	X	X			
Yellow mud turtle	Kinosternon flavescens	C	T	X	X			
Pond slider	Pseudemys scripta	R	E	X	X			
Western box turtle	Terrapene ornata	C	T				X	
Spiny softshell	Trionyx spiniferus	R	N	X	X			
Lizards								
Collared lizard	Crotophytus collaris	C	T			X		
Texas horned lizard	Phrynosoma cornutum	R	T			X	X	
Round-tailed horned lizard	P. modestum	C	S				X	
Le[illegible] earless lizard	Holbrookia maculata	C	T				X	X
Sid[illegible] lotched lizard	Uta stansburiana	C	T			X	X	
Eastern fence lizard	Sceloporus undulatus	C	T		X	X	X	X
Sagebrush lizard	Sceloporus graciosus	R	S				X	
Great Plains skink	Eumeces obsoletus	C	T		X	X	X	
Six-lined racerunner	Cnemidophorous sexlineatus	C	T		X		X	
Checkered whiptail	C. tesselatus	C	W			X	X	

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Table 3.3.2.6-1. Amphibians and reptiles of the Texas/New Mexico M-X study area (Page 2 of 2).

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Aquatic and Shoreline	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Reptiles (continued)								
Snakes								
Checkered garter snake	Thamnophis marcianus	C	T		X		X	X
Texas blind snake	Leptotyphlops dulcis	R	T			X	X	
Western hognose snake	Heterodon nasicus	C	T		X		X	X
Prairie ringneck snake	Diadophis punctatus	C	T		X		X	X
Yellow-bellied racer	Coluber constrictor	R	N		X		X	
Coachwhip	Masticophis flagellum	R	T		X	X	X	X
Glossy snake	Arizona elegans	C	T				X	
Bullsnake	Pituophis melanoleucus	C	T			X	X	X
Corn snake	Elaphe guttata	C	T		X	X		
Central Plains milk snake	Lampropeltis triangulum	R	N,E		X	X	X	X
Kingsnake	L. getulus	C	T		X	X	X	X
Great Plains ground snake	Sonora episcopa	C	T			X	X	
Long-nosed snake	Rhinocheilus lecontei	C	T			X	X	
Plains black-headed snake	Tantilla nigriceps	C	T			X	X	
Texas night snake	Hypsiglena torquata	C	T			X	X	
Desert massasauga	Sistrurus catenatus	R	T		X	X	X	
Western rattlesnake	Crotalus viridis	C	T		X	X	X	
Western diamondback rattlesnake	Crotalus atrox	C	T		X	X	X	

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[1]C - Common; R - Rare

[2]T - Throughout; E - Eastern; W - Western; S - Southern; N - Northern

Sources: Stebbins, 1966, Raun and Gehlbach, 1972.

Table 3.3.2.6-2. Mammals of the Texas/New Mexico M-X study area (Page 1 of 2).

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Aquatic	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Mammals								
Opossums								
Opossum	Didelphis marsupialis	R	E		X			X
Insectivores								
Gray shrew	Notiosorex crawfordi	C	T				X	
Bats								
Cave myotis	Myotis velifer	C	T		X	X		
Long eared myotis	Myotis evotis	R	N		X	X	X	
California myotis	Myotis californicus	C	E				X	
Yuma myotis	Myotis yumanensis	C	T		X		X	
Long-legged myotis	Myotis volans	C	T		X			
Small-footed myotis	Myotis subulatus	C	T		X	X	X	
Silver-haired bat	Lasionycteris noctivagans	C	T		X	X		
Western pipistrel	Pipistrellus hesperus	C	E		X	X		
Big brown bat	Eptesicus fuscus	C	T		X	X		
Hoary bat	Lasionycterus cinereus	C	T		X	X		
Western big-eared bat	Plecotus townsendi	C	T		X	X		
Pallid bat	Antrozous pallidus	C	T		X	X		
Big freetail bat	Tadarida molossa	C	T		X			
Mexican freetail bat	T. brasiliensis	C	T		X			
Armadillos								
Armadillo	Daspus novemcinetus	R	E		X			
Rabbits								
Black-tailed jackrabbit	Lepus californicus	C	T				X	
Eastern cottontail	Sylvilagus floridanus	C	T		X			X
Desert cottontail	Sylvilagus audubonii	C	T			X	X	
Rodents								
Thirteen-lined ground squirrel	Spermophilus tridecemlineatus	C	T				X	X
Spotted ground squirrel	S. spilosoma	C	T			X	X	
Black-tailed prairie dog	Cynomys ludovicianus	C	T				X	
Plains pocket gopher	Goeomys bursarius	C	T				X	X
Mexican pocket gopher	Pappogeomys castanops	C	T				X	
Merriam pocket mouse	Perognathus merriami	C	T				X	
Plains pocket mouse	P. flavescens	C	E				X	
Silky pocket mouse	P. flavus	C	T				X	
Hispid pocket mouse	P. hispidus	C	T				X	

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Table 3.3.2.6-2. Mammals of the Texas/New Mexico M-X study area (Page 2 of 2).

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Aquatic	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Rodents (continued)								
Ord kangaroo rat	Dipodomys ordi	C	T				X	
Beaver	Castor canadensis	R	T		X			
Plains harvest mouse	Reithrodontomys montanus	C	T				X	
Western harvest mouse	R. megalotis	C	T		X		X	X
White-footed mouse	Peromyscus leucopus	C	T		X	X		
Deer mouse	P. maniculatus	C	T		X	X	X	X
Brush mouse	P. boylii	C	T			X	X	
Pinyon mouse	P. truei	C	N			X		
Rock mouse	P. difficilis	C	T			X		
Northern grasshopper mouse	Onychomys leucogaster	C	T				X	
White-throated woodrat	Neotoma albigula	C	T			X	X	
Southern plains woodrat	N. micropus	C	T				X	
Hispid cottonrat	Sigmodon hispidus	C	T		X			X
Norway rat	Rattus norvegicus	C	T		X			X
House mouse	Mus musculus	C	T		X			X
Porcupine	Erithizon dorsatum	C	N			X	X	
Carnivores								
Coyote	Canis latrans	C	T		X	X	X	X
Swift fox	Vulpes velox	R	T				X	
Kit fox	Vulpes macrotis	R	W				X	X
Gray fox	Uroayon cinereoargenteus	C	T		X	X		
Raccoon	Procyon lotor	C	T		X	X		
Ringtail	Bassariscus astutus	R	S			X	X	
Long-tailed weasel	Mustela frenata	R	T		X		X	
Badger	Taxidea taxus	C	T				X	
Spotted skunk	Spilogale gracilis	C	T		X	X	X	X
Striped skunk	Mephitis mephitis	C	T		X			
Bobcat	Lynx rufus	R	T		X	X	X	
Hooved Animals								
Mule deer	Odocoileus hemionus	C	T		X	X		
White-tailed deer	O. virginianus	R	E			X		
Pronghorn	Antilocapra americana	C	T				X	

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[1]Abundance designations are: C - common; and R - rare.

[2]Occurrence designation are: T - throughout; E - east; W - west; N - north; and S - south.

Sources: Davis, 1974; Findley et al., 1975; Bailey, 1931; and Burt and Grossenheider, 1952.

Table 3.3.2.6-3. Birds of the Texas/New Mexico M-X study area (Page 1 of 5).

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Grebes								
Eared grebe	Podiceps nigricollis	U	T	P				
Pied-billed grebe	Podilymbus podiceps	C	T	P				
Herons								
Great blue heron	Ardea herodias	C	T	P	P			
Snowy egret	Leucophoyx thula	U	T	S	S			
Black-crowned night heron	Nycticorax nycticorax	U	T	P	P			
Swans, Ducks and Geese								
Canada goose	Branta canadensis	C	T	M				
Snow goose	Chen hyperborea	U	T	M				
Mallard	Anas platyrhynchos	C	T	W				
Gadwall	A. strepera	C	T	M				
American wigeon	A. americana	C	T	P				
Pintail	A. acuta	C	T	P				
Green-winged teal	A. crecca	C	T	P				
Blue-winged teal	A. discors	U	T	S				
Cinnamon teal	A. cyanoptera	U	T	S				
Shoveler	A. clypeata	U	T	P				
Redhead	Aythya americana	U	T	W				
Canvasback	A. valisineria	U	T	W				
Lesser scaup	A. affinis	C	T	W				
Bufflehead	Bucephala albeola	U	T	W				
Ruddy duck	Oxyura jamaicensis	C	T	P				
Raptors								
Turkey vulture	Cathartes aura	C	T		S		S	S
Sharp-shinned hawk	Accipiter striatus	C	T		W	W		
Cooper's hawk	A. cooperi	C	T		P	P		
Red-tailed hawk	Buteo jamaicensis	C	T			P	P	P
Rough-legged hawk	B. lagopus	C	T		W		W	W
Ferruginous hawk	B. regalis	U	T		P		P	P
Swainson's hawk	B. swainsoni	U	T		S		S	S
Golden eagle	Aquila chrysaetos	C	T				S	S
Bald eagle	Haliaeetus leucocephalus	R	T	W	W			W
Marsh hawk	Circus cyaneus	C	T	W			W	W
Prairie falcon	Falco mexicanus	U	T	P			P	P
American kestrel	F. sparverius	C	T	P	P		P	
Gallinaceous Birds								
Bobwhite	Colinus virginianus	C	T		P		P	P
Scaled quail	Callipepla squamata	C	T		P		P	P
Ring-necked pheasant	Phasianus colchicus	C	T		P			P
Rio Grande turkey	Meleagris gallopavo	U	T		P	P		
Lesser prairie chicken	Tympanuchus pallidicinctus	U	S				P	

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Table 3.3.2.6-3. Birds of the Texas/New Mexico M-X study area (Page 2 of 5).

Common Name	Species	Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Cranes								
Sandhill crane	Grus canadensis	C	T	W				W
American coot	Fulica americana	C	T	P				
Shorebirds								
Snowy plover	Charadrius alexandrinus	U	T	S				
Killdeer	C. vociferus	C	T	P				P
Mountain plover	C. montanus	U	T				S	
Common snipe	Capella gallinago	C	T	P				P
Long-billed curlew	Numenius americanus	U	T	M			M	
Greater yellowlegs	Tringa melanoleuca	C	T	M				
Lessor yellowlegs	T. flavipes	C	T	M				
Baird's sandpiper	Calidris bairdii	C	T	M				
Least sandpiper	C. minutilla	U	T	M				
Western sandpiper	C. mauri	U	T	M				
American avocet	Recurvirostra americana	C	T	S				
Black-necked stilt	Himantopus mexicanus	C	T	S				
Wilson's phalarope	Steganopus tricolor	C	T	S				
Gulls and Terns								
Ring-billed gull	Larus delawarensis	U	T	M				
Franklin's gull	Larus pipixcan	C	T	M				
Forster's tern	Sterna forsteri	U	T	M				
Black tern	Chilidonias niger	U	T	M				
Pigeons and Doves								
Rock dove	Columba livia	C	T				P	
Mourning dove	Zenaida macroura	C	T		P	P	P	P
Cuckoos								
Yellow-billed cuckoo	Coccyzus americanus	R	T		S			
Roadrunner	Geococcyx californianus	U	T				P	
Owls								
Barn owl	Tyto alba	U	S		P			P
Screech owl	Otus asio	U	T		P			
Great horned owl	Bubo virginianus	C	T		P	P		P
Burrowing owl	Athene cunicularia	C	T				P	
Long-eared owl	Asio otus	U	T			S		
Short-eared owl	Asio flammeus	U	T	W				
Nightjars and Swifts								
Poor-will	Phalaenoptilus nuttallii	C	T		S	S		
Common nighthawk	Chordeiles minor	C	T		S	S	S	S
White-throated swift	Aeronautes saxatilis	C	T			S		

Table 3.3.2.6-3. Birds of the Texas/New Mexico M-X study area (Page 3 of 5).

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Woodpeckers								
Common flicker	Colaptes auratus	C	T		W	W		
Red-headed woodpecker	Melanerpes erythrocephalus	U	T		S			
Ladder-backed woodpecker	Picoides scalaris	C	T		P			
Downs woodpecker	P. pubescens	U	T		P			
Flycatchers								
Eastern kingbird	Tyrannus tyrannus	U	T				S	
Western kingbird	T. verticalis	C	T		S		S	
Cassin's kingbird	T. vociferans	U	T		S	S		
Say's phoebe	Sayornis sayus	U	T				S	
Western wood peewee	Contopus sordidulus	U	T		S	S		
Ash-throated flycatcher	Myiarchus cinerus	C	T			S		
Larks								
Horned lark	Eremophila alpestris	C	T				P	P
Swallows								
Violet-green swallow	Tachycineta thalassina	C	T	M	M			
Rough-winged swallow	Stelgidopteryx ruficollis	C	T	S	S			
Barn swallow	Hirundo rustica	C	T	S	S			
Crows and Jays								
Blue jay	Cyanocitta cristata	U	T		P			
Steller's jay	C. stelleri	C	T			P		
Scrub jay	Aphelocoma coerulescens	C	T			P		
White-necked raven	Corvus cryptoleucus	C	T				P	P
Common crow	C. brachyrhychos	C	T					P
Pinyon jay	Gymnorhinus cyanocephalus	C	T			P		
Wrens								
Mountain chickadee	Parus gambeli	U	T		W	W		
Plains titmouse	P. inornatus	U	W			P		
Bushtit	Psaltriparus inornatus	C	T		P	P		
House wren	Troglodytes aedon	C	T		S			
Bewick's wren	Thyromanes bewickii	C	T		P	P		
Longbilled marsh wren	Cistothorus palustris	U	T	S				
Rock wren	Salpinctes obsoletus	U	T			P		
Canyon wren	Catherpes mexicanus	U	T			P		
Cactus wren	Campylorhynchus brunnecapillus	U	T				P	
Red breasted nuthatch	Sitta canadensis	R	T		W			
Brown creeper	Certhia familiaris	R	T		W			

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Table 3.3.2.6-3. Birds of the Texas/New Mexico M-X study area (Page 4 of 5).

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Mockingbird, Catbirds, and Thrashers								
Mockingbird	Mimus polyglottos	C	T		P			
Sage thrasher	Oreoscoptes montanus	C	T			S	S	
Curve-billed thrasher	Toxostoma curverostre	C	T				S	
Gray catbird	Dumatella carolinensis	C	T		M			
Thrushes and Bluebirds								
American robin	Turdus migratorius	C	T		P			
Swainson's thrush	Catharus ustulata	C	T		M			
Eastern bluebird	Sialia sialis	R	T		M			
Mountain bluebird	S. currucoides	C	T			M	M	
Hermit thrush	Catharus guttatus	C	T		M			
Gnatcatchers and Kinglets								
Blue-gray gnatcatchers	Polioptila caerulea	C	T		S	S		
Ruby-crowned kinglet	Regulus calendula	C	T		W	W		
Pipits								
Water pipit	Anthus spinoletta	C	T	M				
Sprague's pipit	A. spragueii	R	T	M			M	
Waxwings								
Cedar waxwing	Bombycilla cedrorum	U	T		W	W		
Shrikes								
Loggerhead shrike	Lanius ludovicianus	C	T		P			P
Starlings								
Starling	Sturnus vulgaris	C	T		P			P
Vireos								
Solitary vireo	Vireo solitarius	C	T		M	M		
Warbling vireo	Vireo gilvus	C	T		M			
Warblers								
Black and white warbler	Mniotilta varia	U	T		M			
Orange-crowned warbler	Vermivora celata	C	T		M			
Nashville warbler	V. ruficapilla	U	T		M			
Virginia's warbler	V. virginiae	U	T		M			
Yellow warbler	Dendroica petechia	C	T		S			
Yellow-rumped warbler	D. coronata	C	T		M			
MacGillivary's warbler	Oporornis tolmiei	U	T		M			
Yellowthroat	Geothlypis trichas	C	T		S			
Yellow-breasted chat	Icteria virens	C	T		S			
Wilson's warbler	Wilsonia pusilla	C	T		M			

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Table 3.3.2.6-3. Birds of the Texas/New Mexico M-X study area (Page 5 of 5).

Species		Relative Abundance in Study Area[1]	Occurrence in Study Area[2]	Habitat Types[3]: Aquatic and Shoreline	Riparian	Canyon Upland	Scrub/ Grassland	Agriculture
Weaver Finches								
House sparrow	Passer domesticus	C	T		P			P
Meadowlarks								
Eastern meadowlark	Sturnella magna	U	T	S				S
Western meadowlark	S. neglecta	C	T	P			P	P
Blackbirds and Orioles								
Yellow-headed blackbird	Xanthacephalus xanthacephalus	C	T	S				
Red-winged blackbird	Agelaius phoeniceus	C	T	P				P
Northern oriole	Icterus galbula	C	T		S			
Brewer's blackbird	Euphagus cyanocephalus	C	T	P			P	P
Great-tailed grackle	Quiscalus mexicanus	C	S	S	S			S
Common grackle	Q. quiscula	C	T	S				S
Brown-headed cowbird	Molothrus ater	C	T	S	S	S	S	S
Western tanager	Piranga ludoviciana	U	T		M	M		
Grosbeaks, Finches, Sparrows, and Buntings								
Black-headed grosbeak	Pheucticus melanocephalus	C	T		S			
Blue grosbeak	Guiraca caerulea	U	T		S			
Lazuli bunting	Paserina amoena	U	T		S			
Dickcissel	Spiza americana	U	T	M				M
Evening grosbeak	Herperiphona vespertina	R	T			W		M
House finch	Carpodacus mexicana	U	T		P			
Pine siskin	Carduelis pinus	U	T		W	W		
American goldfinch	C. tristis	U	T		W			
Lesser goldfinch	C. psaltria	U	T		P			
Rufous-sided towhee	Pipilio erythrothalmus	U	T		S			
Lark bunting	Calamospiza melanocorys	U	T				M	M
Lark sparrow	Chondestes grammacus	U	T		M		M	M
Cassin's sparrow	Aimophila cassinii	C	T				S	
Black-throated sparrow	Amphispiza bilineata	U	T				S	
Dark-eyed junco	Junco hyemalis	C	T		W			
Tree sparrow	Spizella arborea	C	T		W			W
Chipping sparrow	S. passerina	C	T		M	S		M
Clay-colored sparrow	S. pallida	U	T		M			M
Brewer's sparrow	S. breweri	U	T		M		M	M
White-crowned sparrow	Zonotrichia leucophrys	C	T		W			
White-throated sparrow	Z. albicollis	U	T		W			
Lincoln's sparrow	Melospiza lincolnii	U	T		M			
Song sparrow	M. melodia	C	T	P	P			
McCown's longspur	Calcarius mccownii	U	T	W			W	W
Chestnut-collared longspur	Calcarius ornatus	U	T	W			W	W

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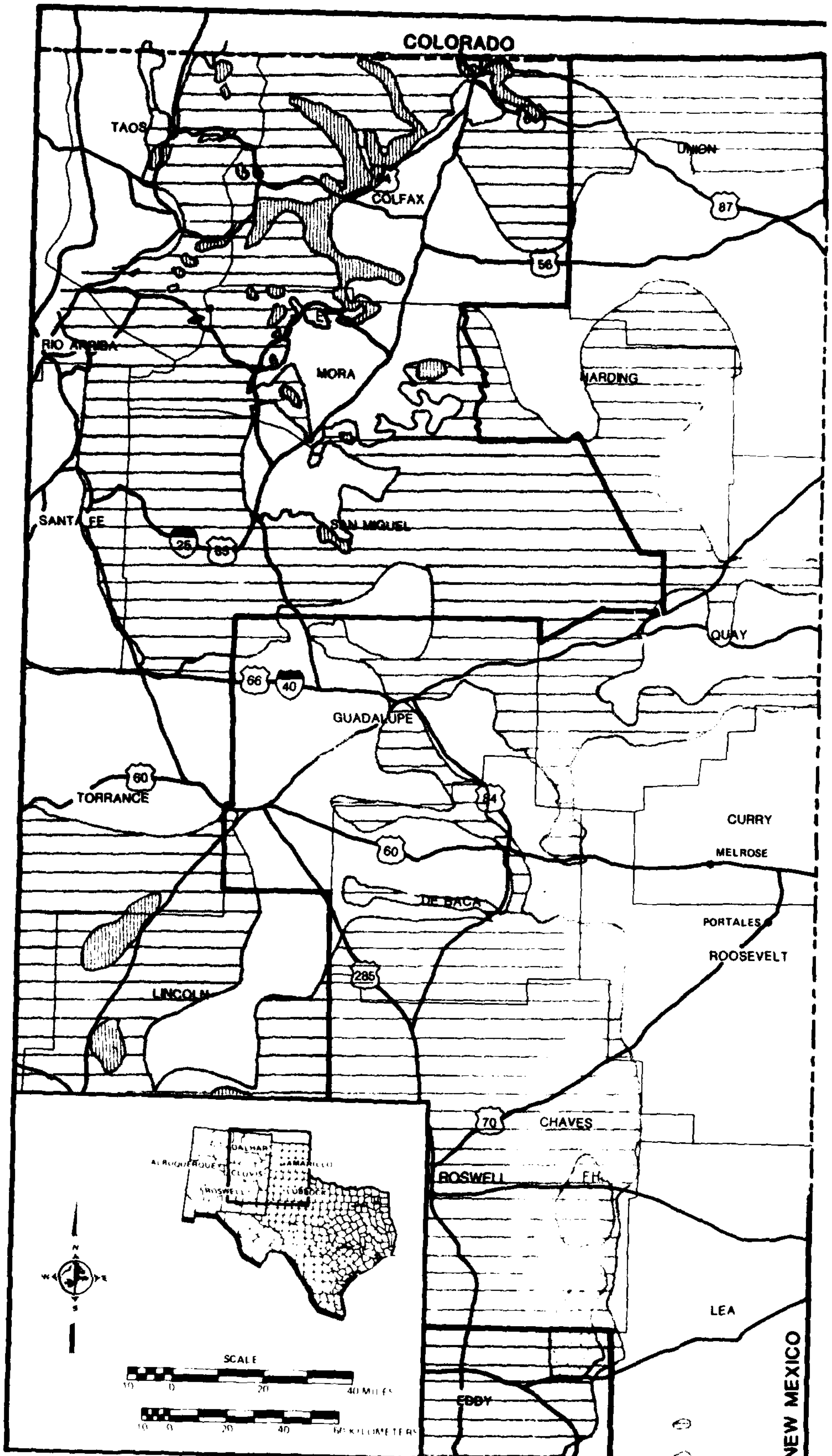
[1]C - Common; U - Uncommon; R - Rare

[2]T - Throughout; S - Southern

[3]Habitat types shown by season of use: S - Summer; W - Winter visitant; P - Permanent resident; M - Migrant in spring and fall

Sources: Curtis and Bierman, 1980; Hubbard, 1978; Robbins et al., 1966.



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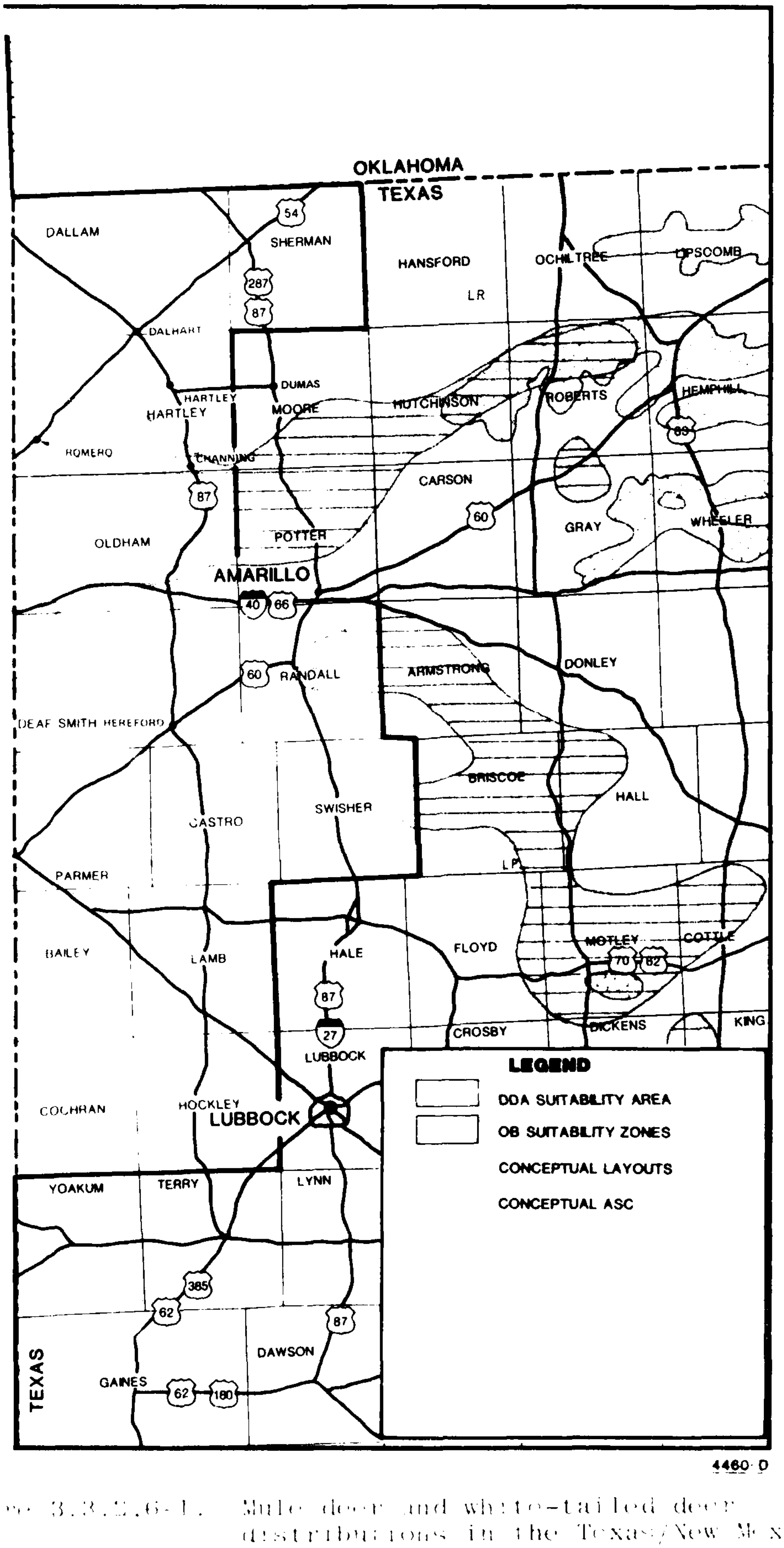
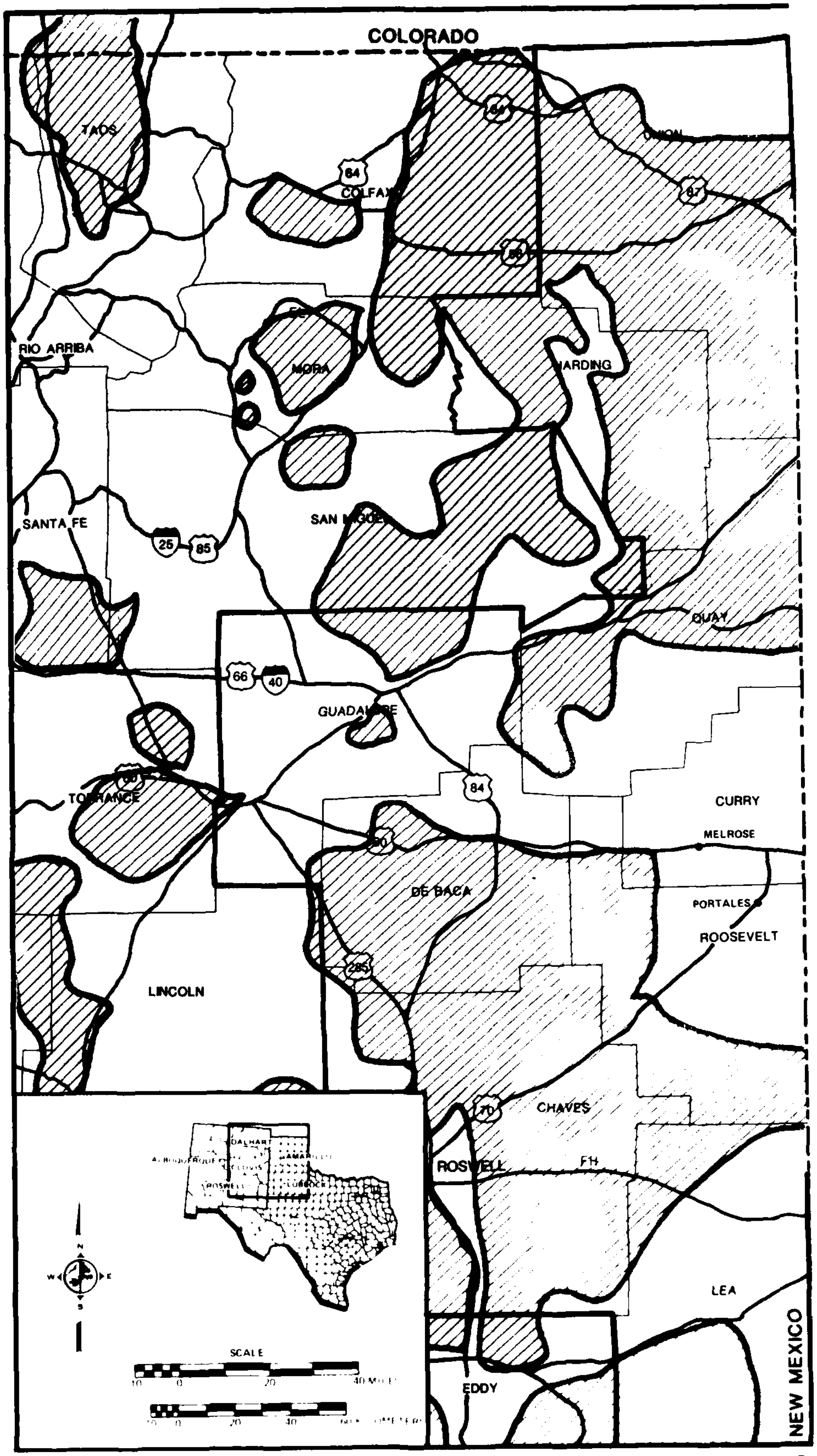


Figure 3.3.2.6-1. Mule deer and white-tailed deer distributions in the Texas/New Mexico study area.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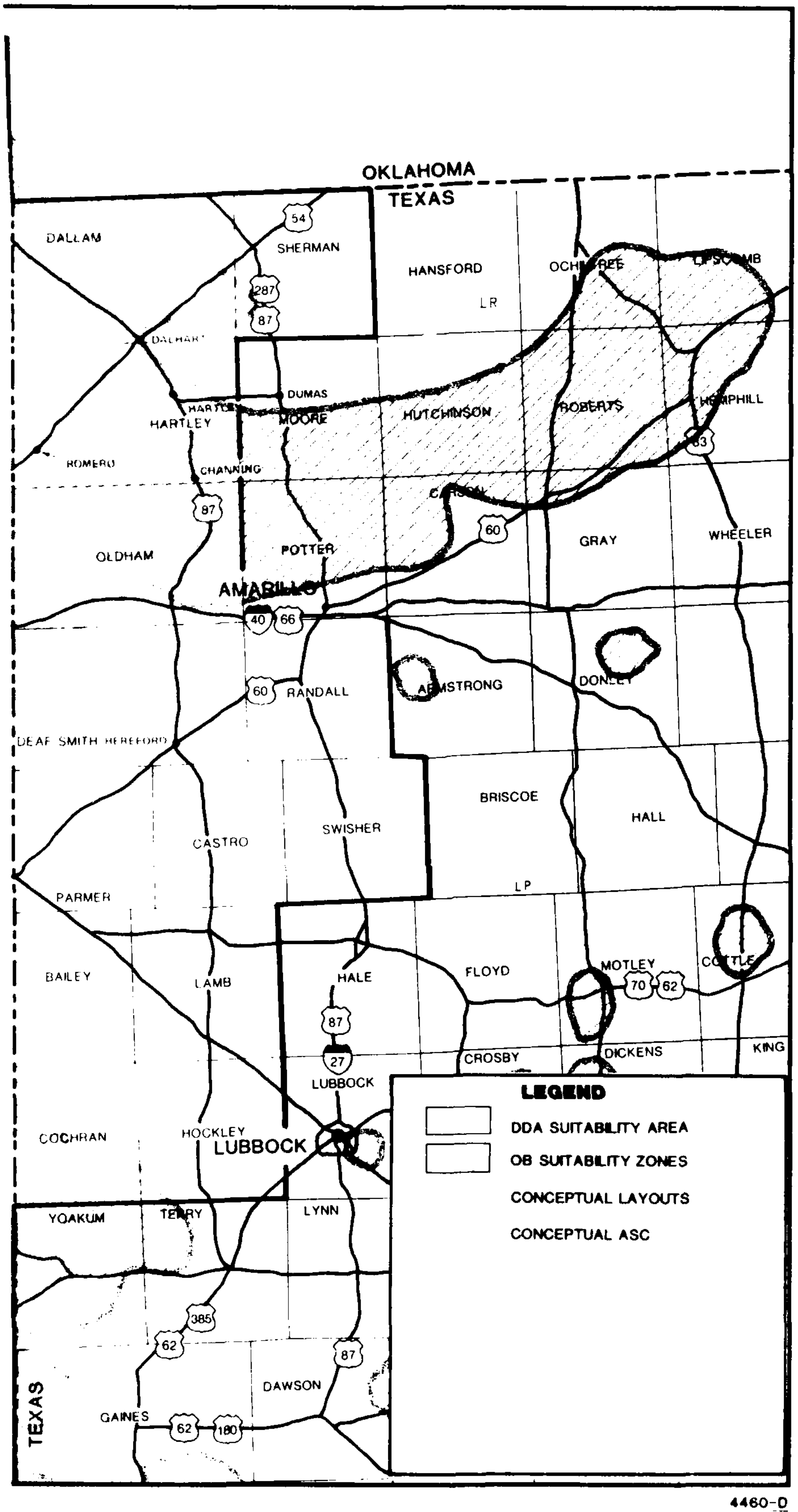
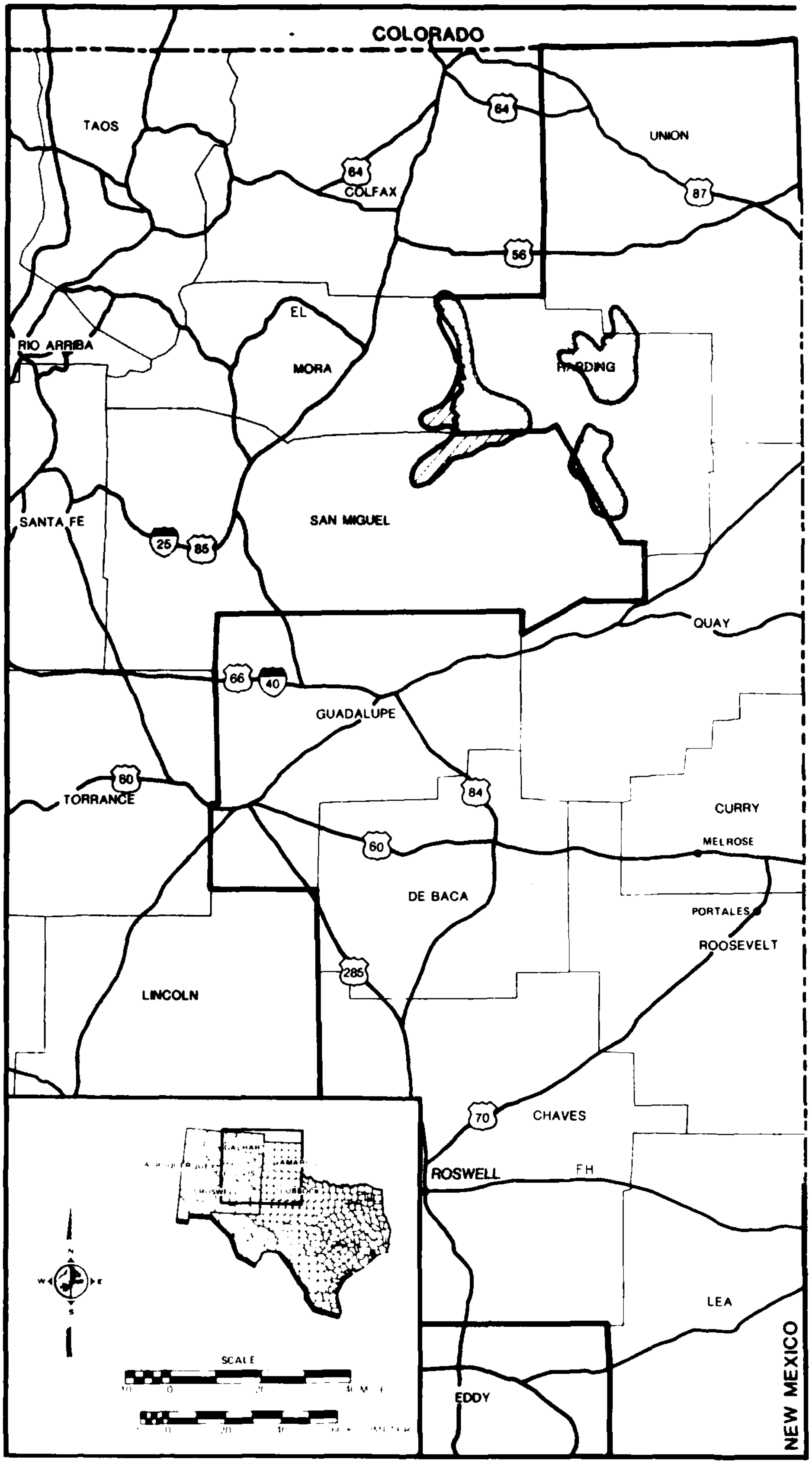


Figure 3.3.2.6-2. Pronghorn range in the Texas/New Mexico study area.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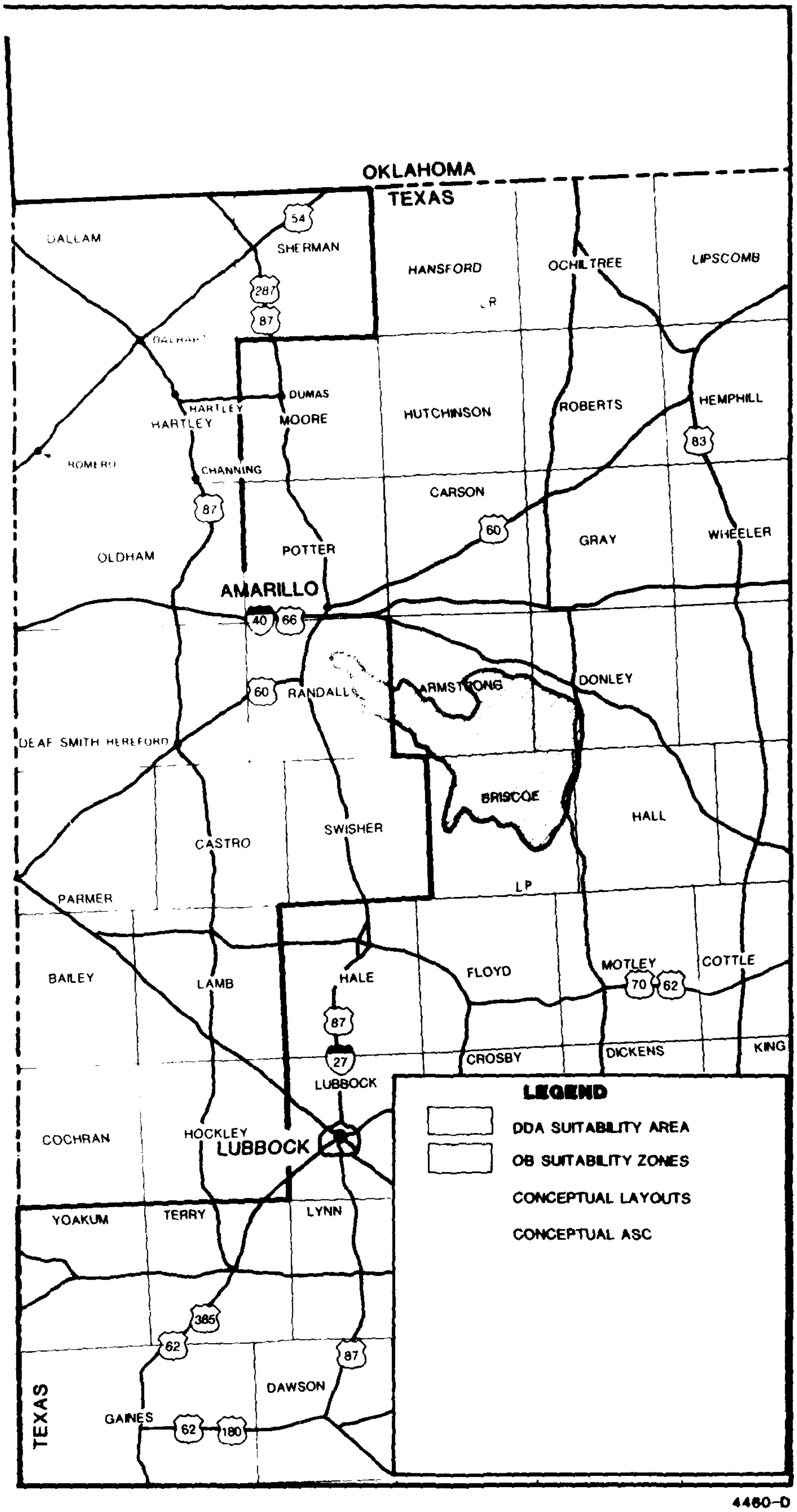
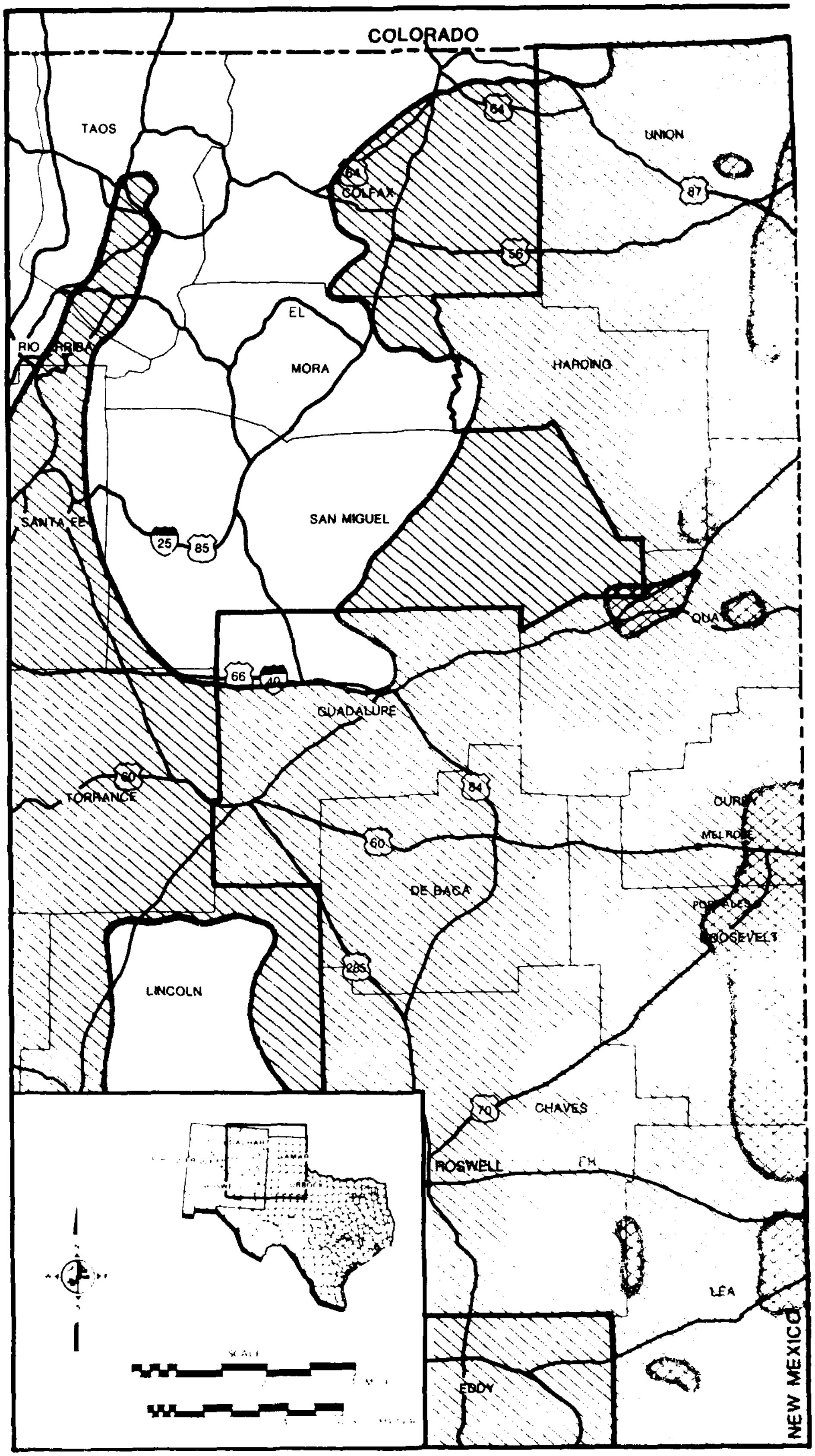


Figure 3.3.2.6-3. Barbary sheep distribution in the Texas-New Mexico study area.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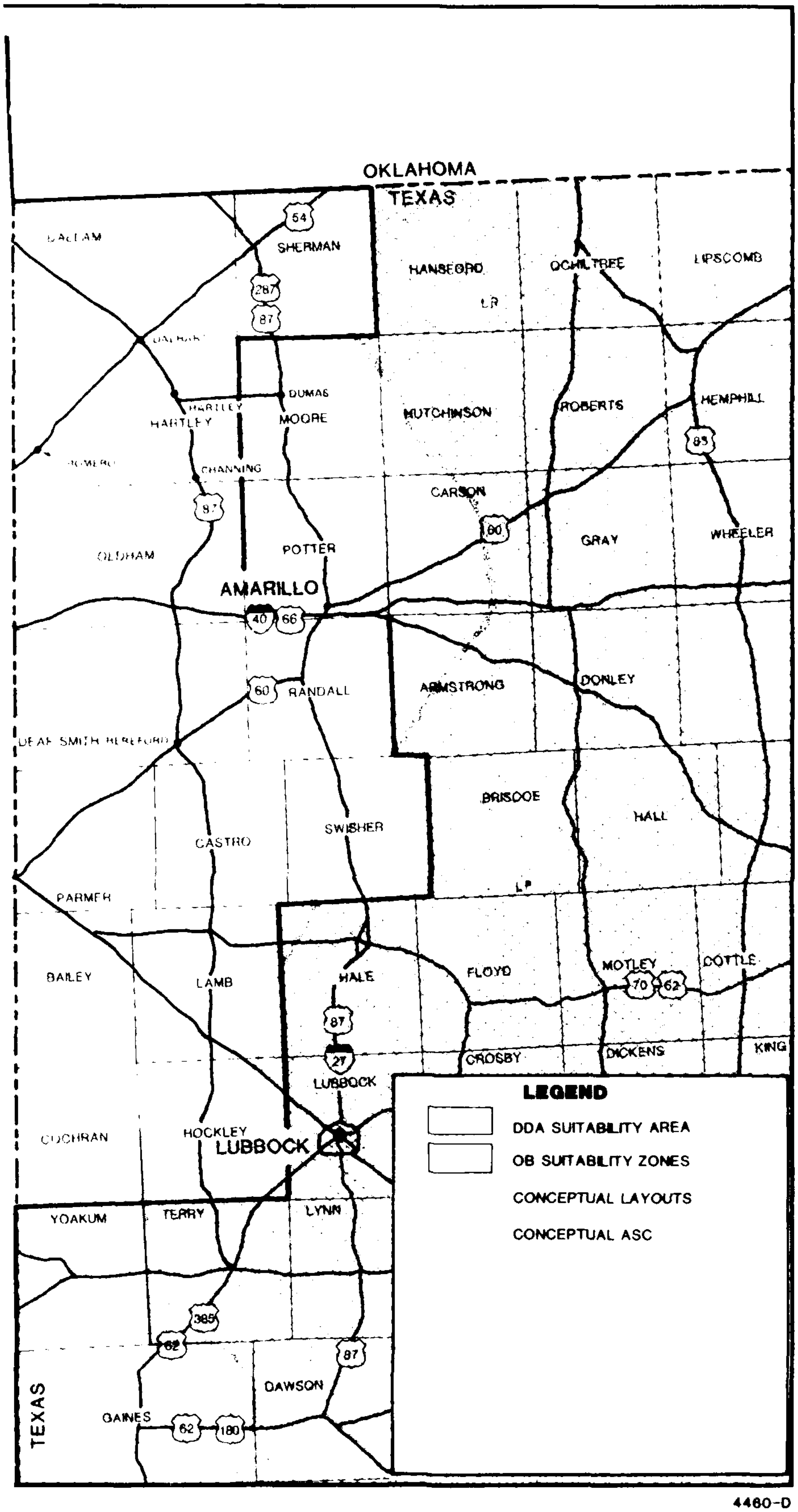
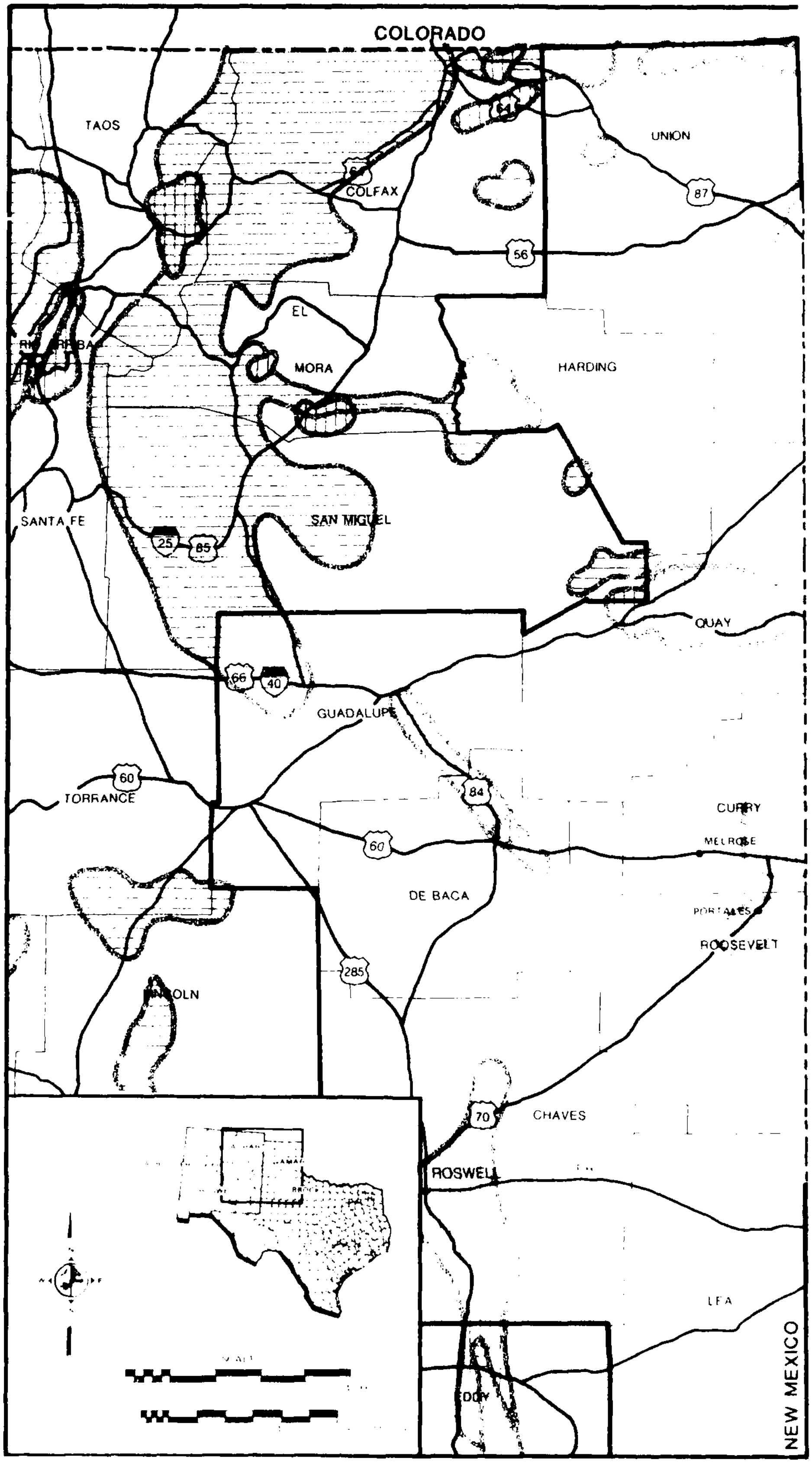


Figure 3.3.2.6-1. Bobwhite and scaled quail distribution in the Texas/New Mexico study area.



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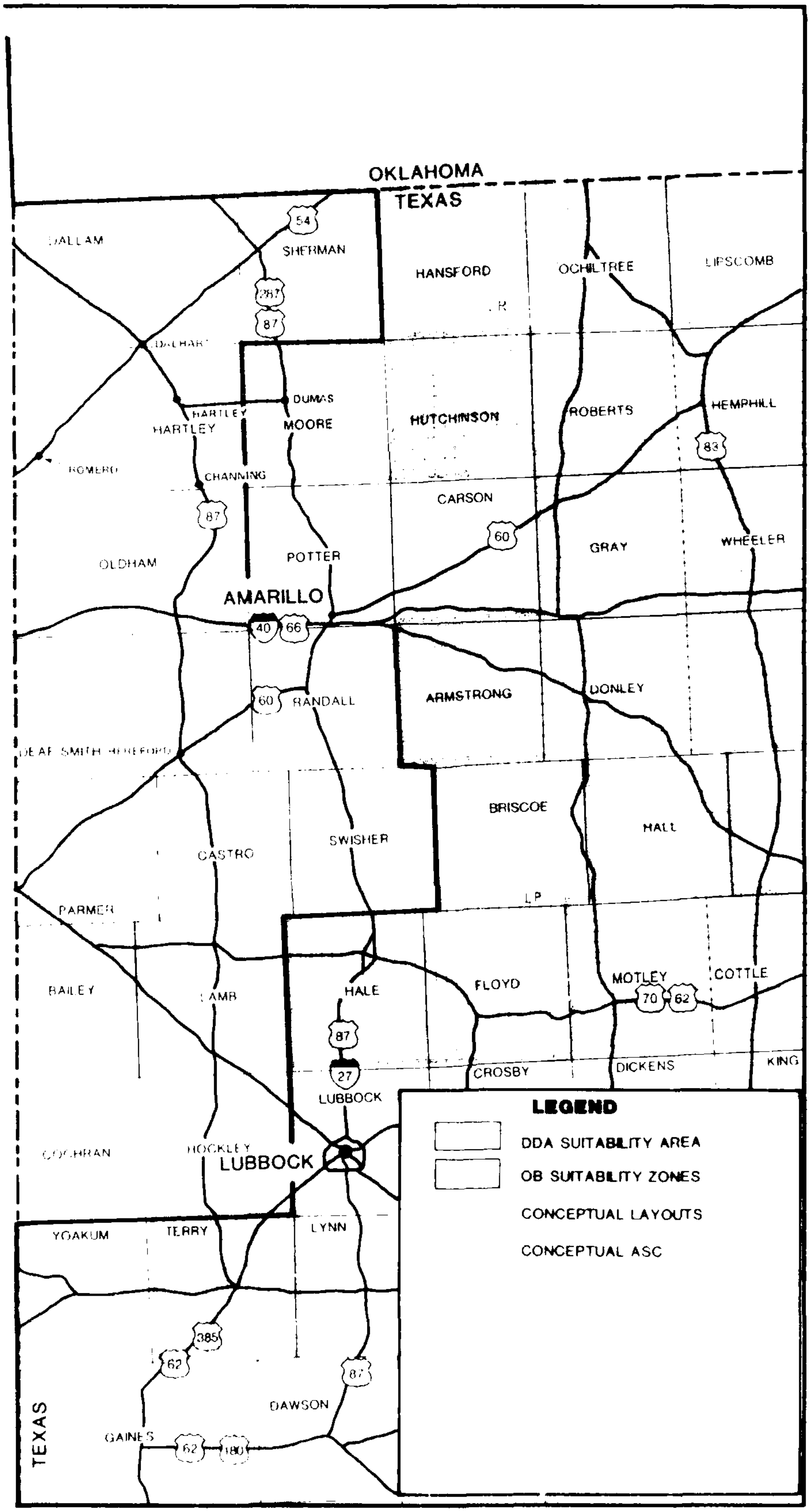
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HUTCHINSON
ROBERTS
HEMPHILL
ROMERO
CHANNING
CARSON
GRAY
WHEELER
OLDHAM
POTTER
AMARILLO
RANDALL
ARMSTRONG
DONLEY
DEAF SMITH
BRISCOE
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SWISHER
PARMER
BAILEY
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MOTLEY
COTTLE
CROSBY
DICKENS
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LUBBOCK
COCHRAN
HOCKLEY
LUBBOCK
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LEGEND

DISTRIBUTION OF THE LESSER PRAIRIE CHICKEN

LESSER PRAIRIE CHICKEN RANGE IN AND NEAR THE TEXAS/NEW MEXICO M-X STUDY AREA.

RANGELAND WITHIN LESSER PRAIRIE CHICKEN RANGE.

COUNTIES WITH HIGH LESSER PRAIRIE CHICKEN ABUNDANCE INDEX (MORE THAN 1 BIRD TAKEN PER HUNTER). [1]

COUNTIES WITH MODERATE LESSER PRAIRIE CHICKEN ABUNDANCE INDEX (BETWEEN 0 AND 1 BIRD TAKEN PER HUNTER). [1]

LESSER PRAIRIE CHICKEN STATE RESTORATION AREA.

NOTES:

[1] COUNTIES WITH LOW LESSER PRAIRIE CHICKEN ABUNDANCE INDEX ARE NOT SHADED. TEXAS DATA ARE NOT AVAILABLE FOR EACH COUNTY.

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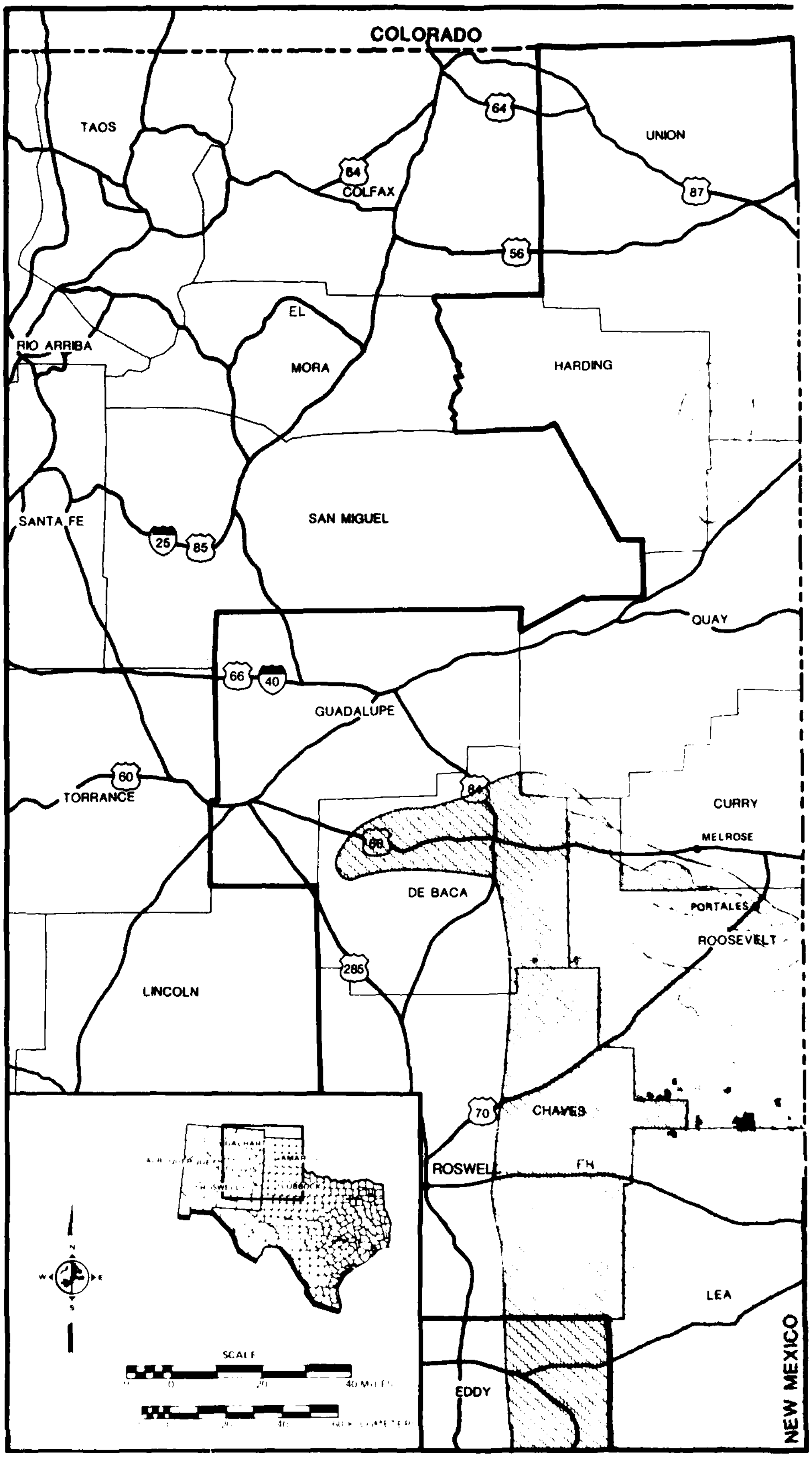
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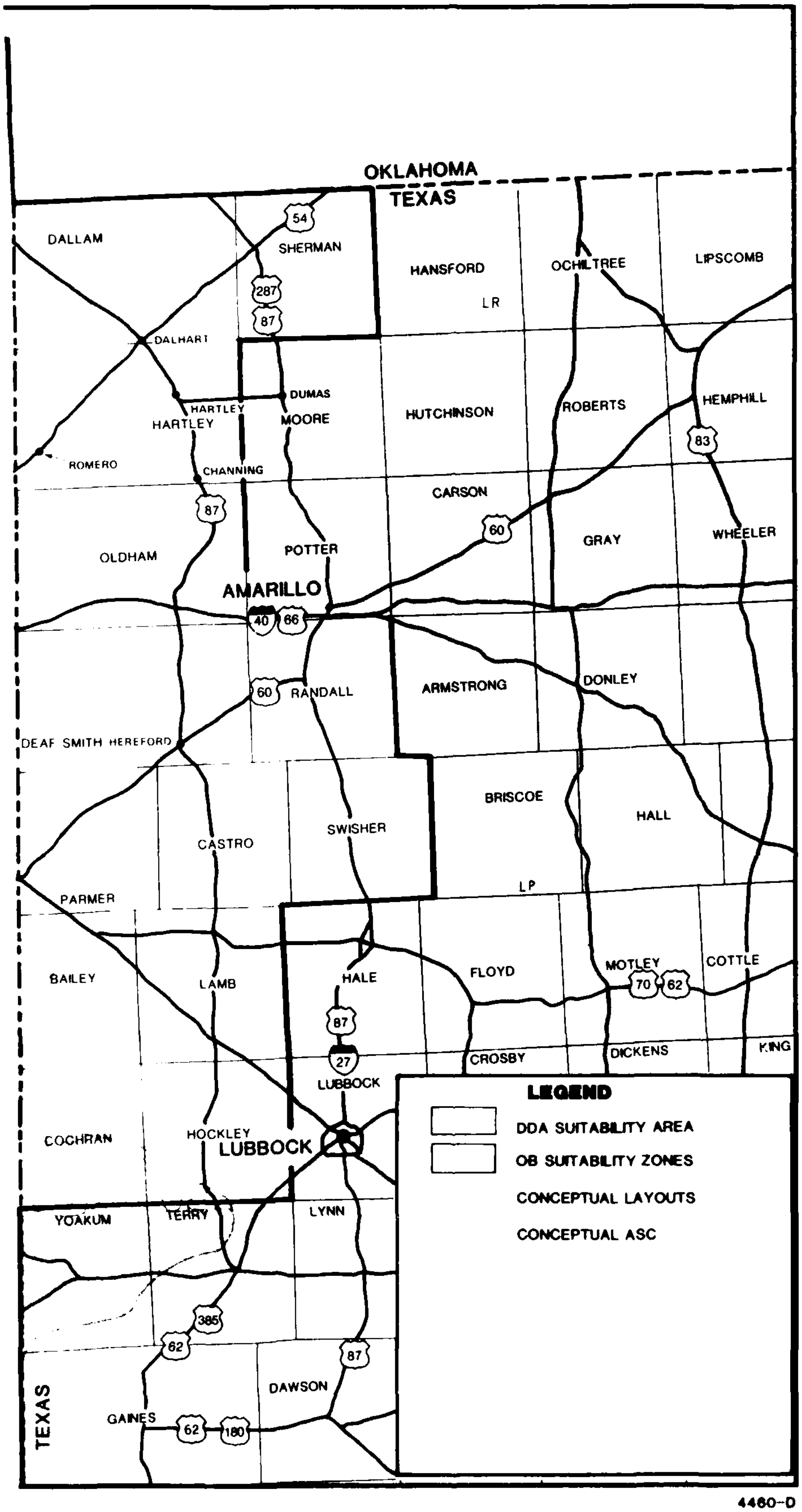
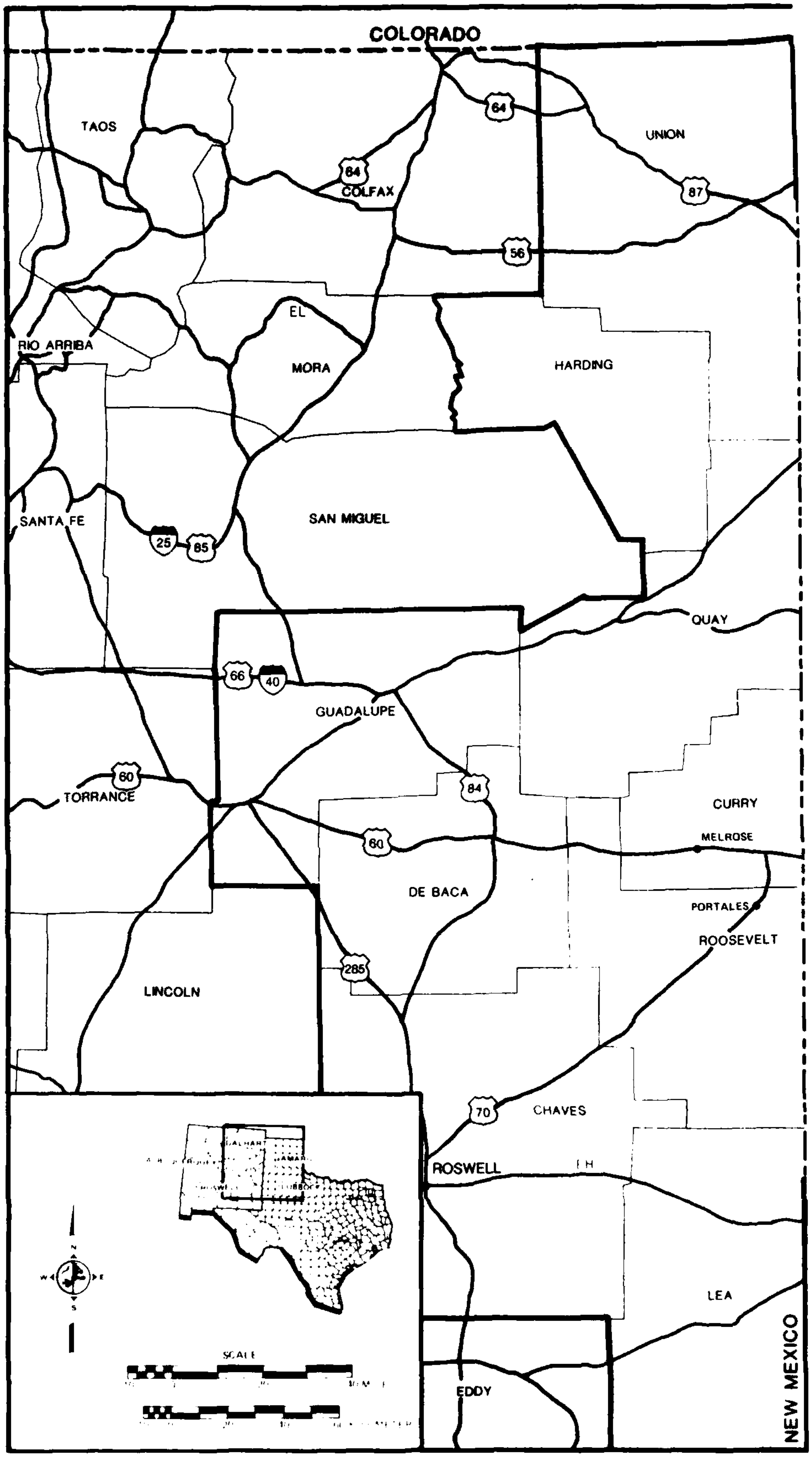


Figure 3.3.2.6-6. Distribution of lesser prairie chicken in and near the Texas/New Mexico study area.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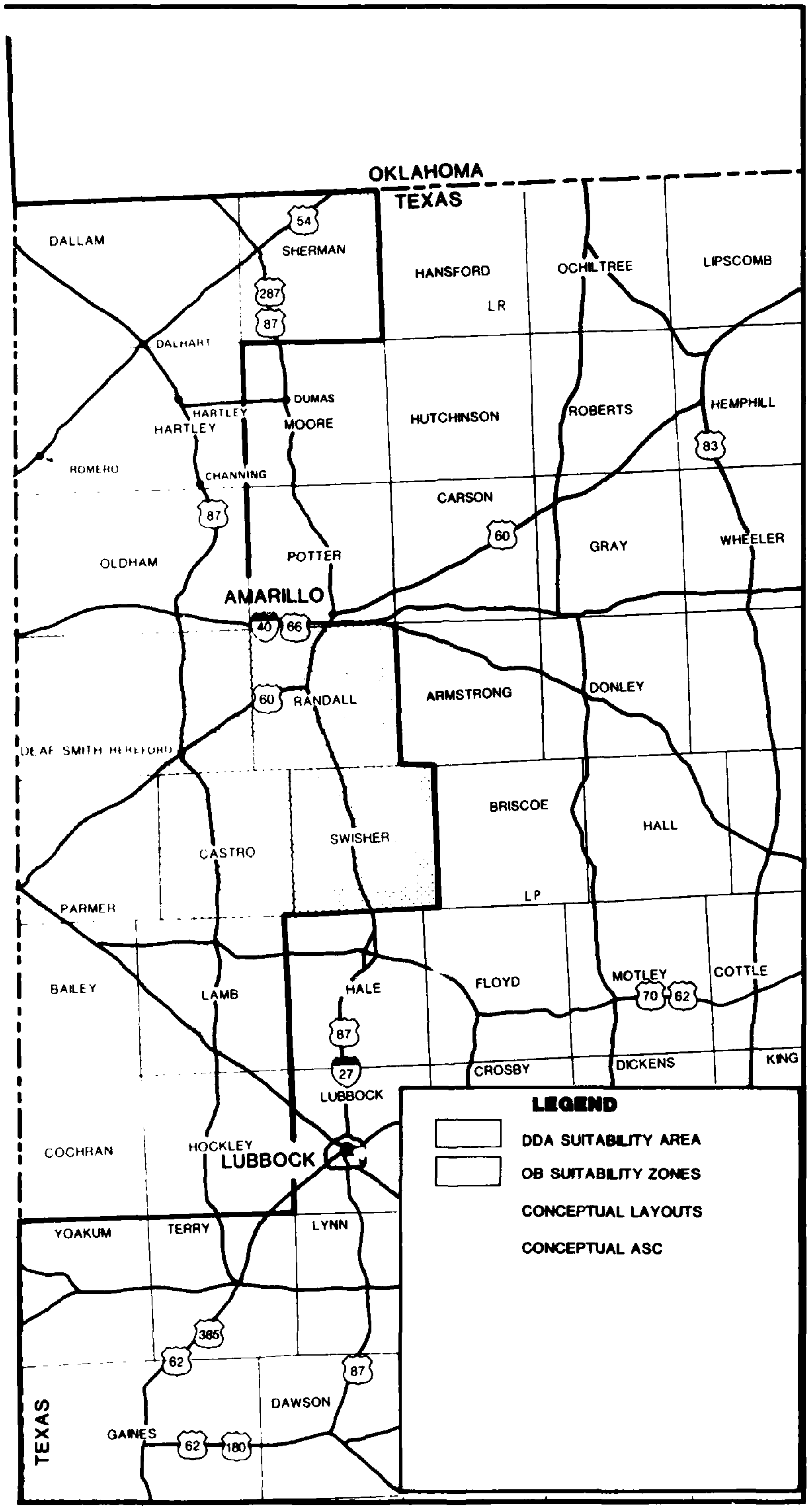

Figure 3.3.2.6-7. Playa lakes abundance in and near the Texas/New Mexico study area.

Aquatic Species (3.3.2.7)

Aquatic Habitat (3.3.2.7.1)

Playa lakes are the major aquatic habitat, but biotic diversity is limited by harsh conditions (e.g., periodic drying, high salinity, wide fluctuations in water level, and agricultural and oil field pollution). Other aquatic habitats include a few rivers, reservoirs, and numerous streams (Figure 3.3.2.6-7).

Aquatic Biota (3.3.2.7.2)

Twenty-eight fish species in the area have some commercial or sport value (Table 3.3.2.7-1). Several minnow species, game fish species, and rough fish are found in the river systems, reservoirs, and ponds. In many areas, highly mineralized or intermittent waters allow only native and introduced fishes such as carp, carpsuckers, and red shiner to survive. The most significant sport fishes are largemouth bass, catfish, and sunfish.

Protected Species (3.3.2.8)

The term "protected species" applies to rare, threatened, or endangered species that are candidates for, or are already included on, state or federal lists. For federally listed, proposed, and candidate species, informal Section 7 consultation with the U.S. Fish and Wildlife Service was initiated by the Air Force on 20 August 1980. Written communication from the Boise, Idaho Area Office dated 4 February 1981 listed the species of concern (see below).

Plant Species

No federally protected plant species occur in the study area. Kuenzler's barrel cactus (Echinocereus kuenzleri) is the closest federally listed endangered species: it is known to occur in the Sacramento Mountains, southwest of the study area. One federal candidate rare plant species (Euphorbia strictior) occurs within the DDA, and another species, the dune unicorn plant (Proboscidea sabulosa), is of concern to the USFWS. Its distribution, along with that of the Euphorbia, is shown in Figure 3.3.2.8-1. No state-proposed protected species occur within the study area. For greater detail regarding plants, see ETR-17, Protected Species.

Wildlife

Five federally listed species of terrestrial wildlife have been reported in the Texas/New Mexico M-X area, black-footed ferret, bald eagle, peregrine falcon, whooping crane, and Eskimo curlew. Only the bald eagle is regularly seen in the area, where it is a winter visitor. Twenty-one species of wildlife occurring in or near the M-X are listed as protected in Texas or New Mexico. A list and map of threatened and endangered animal species is provided in Table 3.3.2.8-1 and Figure 3.3.2.8-2, respectively.

Aquatic Species

Protected fish occur mostly in the Pecos River near Roswell, Fort Sumner, and Santa Rosa, in the Canadian River near the Texas border, and in Ute Creek near

Table 3.3.2.7-1. Common fishes of the Texas/New Mexico study area (Page 1 of 2).

Species Name	Common Name	Status[4]	Drainage P[1]	Drainage C[2]	Drainage R[3]
Lepistosteus spatula	alligator gar	S,Cm			X
L. osseus	longnose gar	S,Cm			X
Dorosoma cepedianum	gizzard shad		X	X	X
Esox lucius	northern pike	S		X	X
Hiodon alosoides	goldeye			X	X
Ictiobus bubalus	smallmouth buffalo	S,Cm	X		X
I. cyprinellus	bigmouth buffalo	S,Cm			X
I. niger	black buffalo		X		X
Carpiodes carpio	river carpsucker	Cm	X	X	X
Catostomus commersoni	white sucker		X	X	
Cyprinus carpio	carp	S,Cm	X	X	X
Gila nigrescens	Rio Grande chub		X	X	
Chrosomus erythrogaster	redbelly dace			X	
Semotilus atromaculatus	creek chub		X	X	
Hybopsis gracilis	flathead chub		X	X	
H. aestivalis	speckled chub		X	X	X
Hybognathus placitus	plains minnow		X	X	X
H. nuchalis	silvery minnow				X
Pimephalus vigilax	bullhead minnow	Cm			X
P. promelas	fathead minnow	Cm	X	X	X
Campostoma anomalus	stoneroller		X	X	X
Carassius auratus	goldfish			X	X
Notropis jemezanus	Rio Grande shiner		X		
N. lutrensis	red shiner	Cm	X	X	X
N. stramineus	sand shiner	Cm	X	X	X
N. percobromus	plains shiner				X
N. oxyrhynchus	sharpnose shiner			X	
N. blennius	river shiner			X	X
N. potteri	chub shiner			X	X
N. buccula	smalleye shiner			X	
N. venustus	blacktail shiner	Cm		X	
N. volucellus	mimic shiner			X	
N. buchanani	ghost shiner			X	
N. bairdi	Red River shiner				X
Notemigonus chrysoleucas	golden shiner	Cm		X	X
Ictalurus punctatus	channel catfish	S,Cm	X	X	X
I. furcatus	blue catfish	S,Cm	X	X	X
Ictalurus melas	black bullhead	S,Cm	X	X	X
I. natalis	yellow bullhead	S,Cm	X	X	X
I. lupus	headwater catfish		X		
Noturus gyrinus	tadpole madtom			X	
Pylodictis olivaris	flathead catfish		X	X	X
Fundulus kansae	plains killifish		X	X	X
F. zebrinus	southwestern killifish		X		

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Table 3.3.2.7-1. Common fishes of the Texas/New Mexico study area (Page 2 of 2).

Species Name	Common Name	Status[4]	Drainage P[1]	C[2]	R[3]
Cyprinodon rubrofluviatilis	Red River pupfish			X	X
Gambusia affinis	mosquitofish		X	X	
Morone chrysops	white bass	Cm		X	X
M. saxatilis	striped bass	S	X		
Micropterus salmoides	largemouth bass	S			
M. punctulatus	spotted bass	S	X		X
Lepomis gulosus	warmouth	S	X	X	
L. auritus	yellowbelly sunfish	S			X
L. cyanellus	green sunfish	S		X	X
L. punctatus	spotted sunfish			X	
L. microlophus	redear sunfish	S	X	X	X
L. macrochirus	bluegill	S	X	X	X
L. humilis	orange-spotted sunfish	S		X	X
L. megalotis	longear sunfish	S	X	X	X
Poxomis annularis	white crappie	S	X	X	
P. nigromaculatus	black crappie	S	X		
Perca flavescans	yellow perch	S	X		
E. spectabile	orangethroat darter			X	
Stizostedion vitreum	walleye			X	
Percina caprodea	logperch			X	X
Aplodinotus grunniens	freshwater drum	S,Cm		X	X
Moxostoma congestum	gray redhorse		X		X

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[1]P = Pecos River

[2]C = Canadian and Arkansas rivers

[3]R = Red River

[4]S = Sport; Cm = Commercial

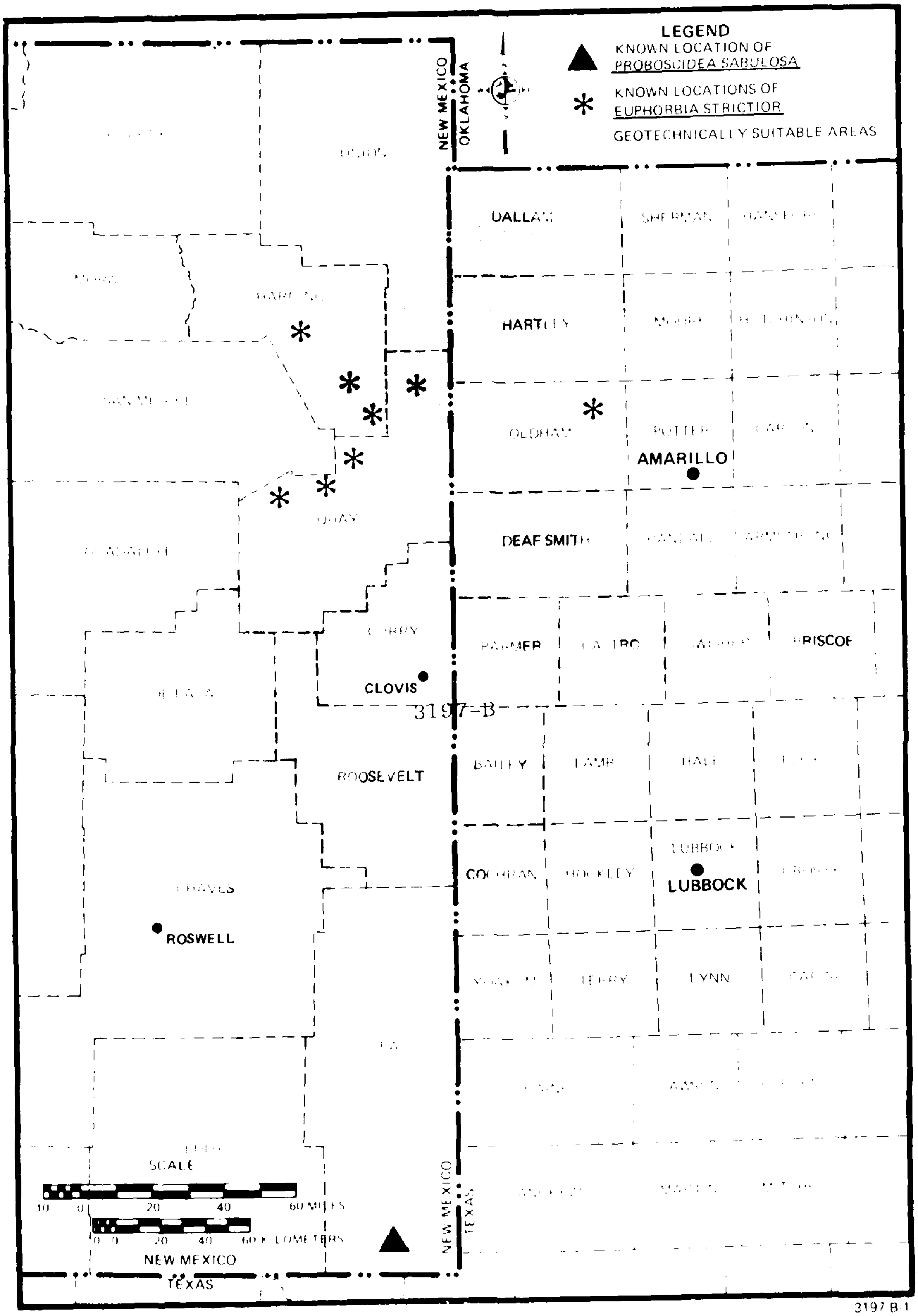

Figure 3.3.2.8-1. Federal candidate rare plants in the Texas/New Mexico study area.

Table 3.3.2.8-1 Endangered and threatened animal species in the Texas/New Mexico High Plains area (Page 1 of 4).

Species	Federal	Texas[1]	New Mexico[2]	Status	Habitat
Mammals					
Black-footed ferret (Mustela nigripes)	E	E	E	Resident	Prairie dog towns
Birds					
Eskimo curlew (Numenius borealis)	E	E	E	Migrant[3]	Grassland and playas
Olivaceous cormorant (Phalacrocorax olivaceus)			T	Occasional[1]	Lakes, reservoirs
Little blue heron (Florida caerulea)			E	Occasional	River marshes
Mississippi kite (Ictinia misisippiensis)			T	Occasional breeder[5]	Riparian woods
Zone-tailed hawk (Buteo albonotatus)		T	T	Occasional breeder	Canyons
Bald eagle (Haliaeetus leucocephalus)	E	E	E	Winter resident	River valleys
Osprey (Pandion haliaetus carolinensis)		T	T	Migrant	River valleys
Peregrine falcon (Falco peregrinus)	E	E	E	Migrant	All habitats
Whooping crane (Grus americana)	E	E	T	Migrant	River valleys, fields, and marshes

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Table 3.3.2.8-1 Endangered and threatened animal species in the Texas/New Mexico High Plains area (Page 2 of 4).

Species	Federal	Texas[1]	New Mexico[2]	Status	Habitat
Birds (continued)					
Interior least tern (Sterna albifrons athalassos)		E	T	Occasional breeder	River valleys
Red-headed woodpecker (Melanerpes erythrocephalus caurinus)			T	Occasional breeder	Riparian woods
White-faced ibis (Plegadis chihi)		T		Migrant	River valleys
Bell's vireo (Vireo belli)			T	Occasional breeder	Riparian shrubs, woods
Baird's sparrow (Ammodramus bairdi)			T	Winter resident	Grasslands
McCown's longspur (Calcarius mccowni)			T	Winter resident	Shortgrass
Reptiles					
Big Bend milk snake (Lampropeltis triangulum celaenops)		T		Resident	Grassland, woods
Central Plains milk snake (Lampropeltis triangulum gentilis)		T		Resident	Grassland
Pecos western ribbon snake (Thamnophis proximus diabolicus)			T	Resident	Edges of ponds, streams
Texas horned lizard (Phrynosoma cornutum)			T	Resident	In open terrain
Sand dune sagebrush lizard (Sceloporus graciosus arenicolus)			T	Resident	Active sand dunes

T869/9-15-81/F

Table [illegible] Endangered and threatened animal species in the Texas/New Mexico High Plains area (Page 3 of 4).

Species	Federal	Texas[1]	New Mexico[2]	Status	Habitat
Reptiles (continued)					
Texas slider (Chrysemys concinna texana)			T	Resident	Rivers, ponds
Spiny softshell turtle (Trionyx spiniferus hartwegi)			T	Resident	Rivers, reservoirs
Smooth softshell turtle (Trionyx muticus)			T	Resident	Rivers, reservoirs
Amphibians					
Eastern barking frog (Hylactophryne augusti latrans)			T	Resident	Limestone regions
Blanchard's cricket frog (Acris crepitans blanchardi)			T	Resident	Pond, stream edges
Fish					
American eel (Anguilla rostrata)			E	Summer resident[3]	Rivers, streams
Blue sucker (Cycleptus elongatus)			E	Resident	Large rivers
Gray redhorse (Moxostoma congestum)			E	Resident	Rivers, large streams
Mexican tetra (Astyanax mexicanus)			T	Resident	All permanent water bodies
Roundnose minnow (Dionda episcopa)			T	Resident	Creeks, springs
Canadian speckled dace (Hybopsis aestivalis tetranemus)			T	Resident	Rivers (below Ute Dam)
Arkansas River shiner (Notropis girardi)			E	Resident	Rivers, streams

T869/9-15-81/F

Table 3.3.2.3-1 Endangered and threatened animal species in the Texas/New Mexico High Plains area (Page 4 of 4).

Species	Federal	Texas[1]	New Mexico[2]	Status	Habitat
Fish (continued)					
Silverband shiner (Notropis shumardi)			E	Resident	Large rivers
Suckermouth minnow (Phenacobius mirabilis)			T	Resident	Streams with gravel bottoms
Bluntnose shiner (Notropsis simus)	C		E	Resident	Pecos River (known historically)
Pecos pupfish (Cyprinodon sp.)			T	Resident	Springs, sinks, ponds
Rainwater killifish (Lucania parva)			T	Resident	Swamps
Greenthroat darter (Etheostoma lepidum)			T	Resident	Vegetated springs
Bigscale logperch (Percina macrolepida)			T	Resident	Small lakes, rocky silt bottoms
Pecos gambusia (Gambusia nobilis)	E		E	Resident	Sinkholes, springs (known from 8 locations)
Headwater catfish (Ictalurus lumpus)	C			Resident[4]	Pecos River

T869/9-15-81/F

E = Endangered (in Texas = Endangered; in New Mexico = Group I).
T = Threatened (in Texas = Protected; in New Mexico = Group II).
C = Candidate for federal protection.

[1]Source: Texas Parks and Wildlife, 1978a, 1978b.

[2]Source: Hubbard, et al., 1978.

[3]Possibly extirpated.

[4]Breeds west of study area.

[5]Winters outside of area.

LEGEND

PROTECTED TERRESTRIAL ANIMAL SPECIES OF THE TEXAS/NEW MEXICO M-X STUDY AREA[1]

MAMMALS AND BIRDS

A BLACK-FOOTED FERRET[2]
B OLIVACEOUS CORMORANT
C LITTLE BLUE HERON
D MISSISSIPPI KITE
E ZONE-TAILED HAWK
F BALD EAGLE
G OSPREY
H PEREGRINE FALCON
I WHOOPING CRANE[3]
J ESKIMO CURLEW[3]
K INTERIOR LEAST TERN
L RED-HEADED WOODPECKER
M WHITE-FACED IBIS[4]
N BELL'S VIREO
O BAIRD'S SPARROW
P MC COWN'S LONGSPUR

REPTILES AND AMPHIBIANS

Q BIG BEND MILKSNAKE
R CENTRAL PLAINS MILKSNAKE[5]
S PECOS WESTERN RIBBON SNAKE
T TEXAS HORNED LIZARD[4]
U SAND DUNE SAGEBRUSH LIZARD[6]
V TEXAS SLIDER TURTLE
W SPINY SOFTSHELL TURTLE[5]
X SMOOTH SOFTSHELL TURTLE[5]
Y EASTERN BARKING FROG
Z BLANCHARD'S CRICKET FROG[7]

NOTES

[1]SOURCES: TEXAS PARKS AND WILDLIFE 1978a, 1978b; HUBBARD et al., 1978.
[2]BASED ON HISTORICAL AND RECENT UNVERIFIED SIGHTINGS.
[3]NOT MAPPED - RARE HISTORICAL MIGRANT.
[4]NOT MAPPED - UNCOMMON THROUGHOUT.
[5]DISTRIBUTED IN NORTHERN AND EASTERN PORTION OF M-X AREA.
[6]DISTRIBUTION LIMITED TO MESCALERO SANDS OF EASTERN CHAVES AND NORTHEASTERN EDDY COUNTIES.
[7]DISTRIBUTED IN SOUTHERN AND WESTERN PORTION OF M-X AREA.

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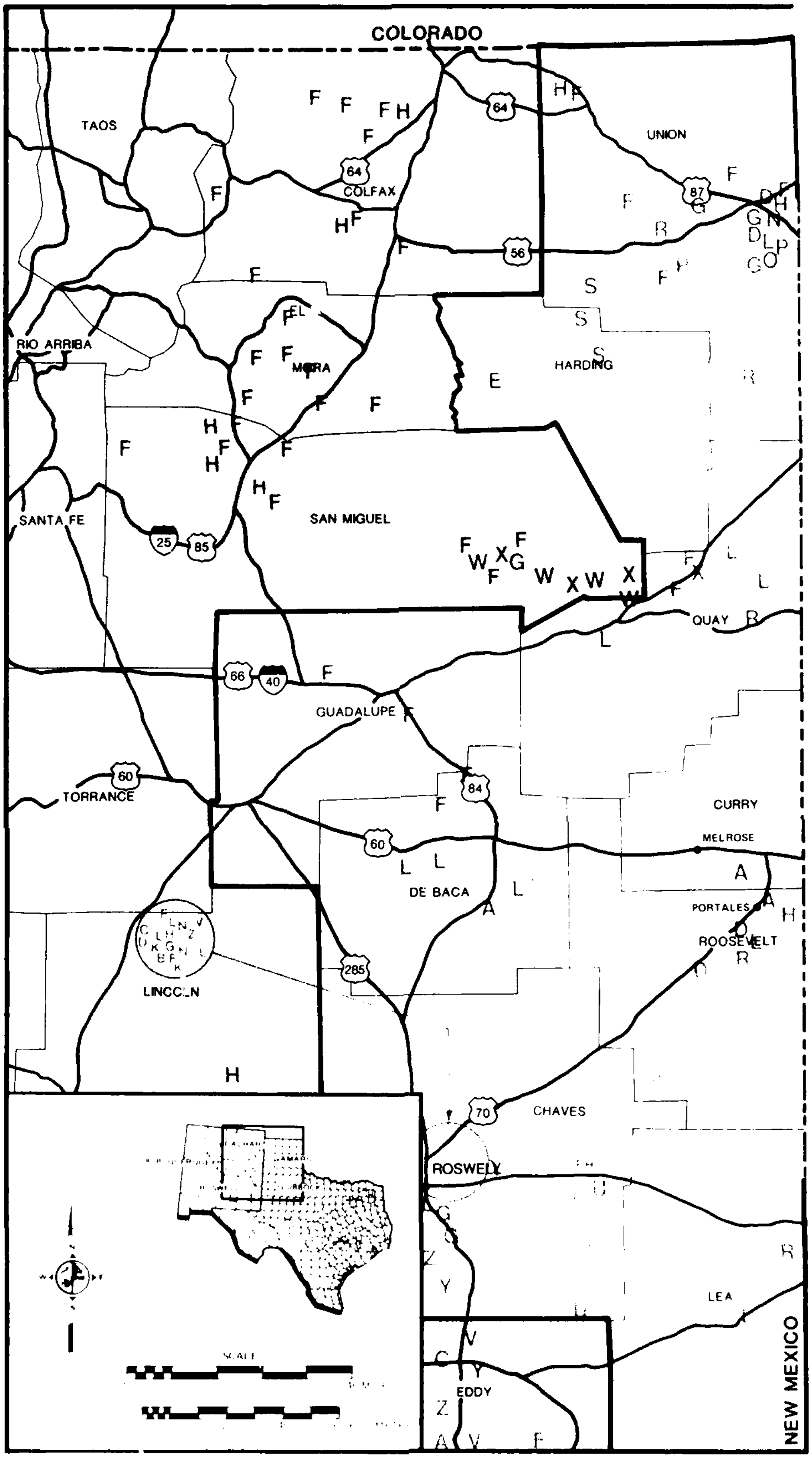
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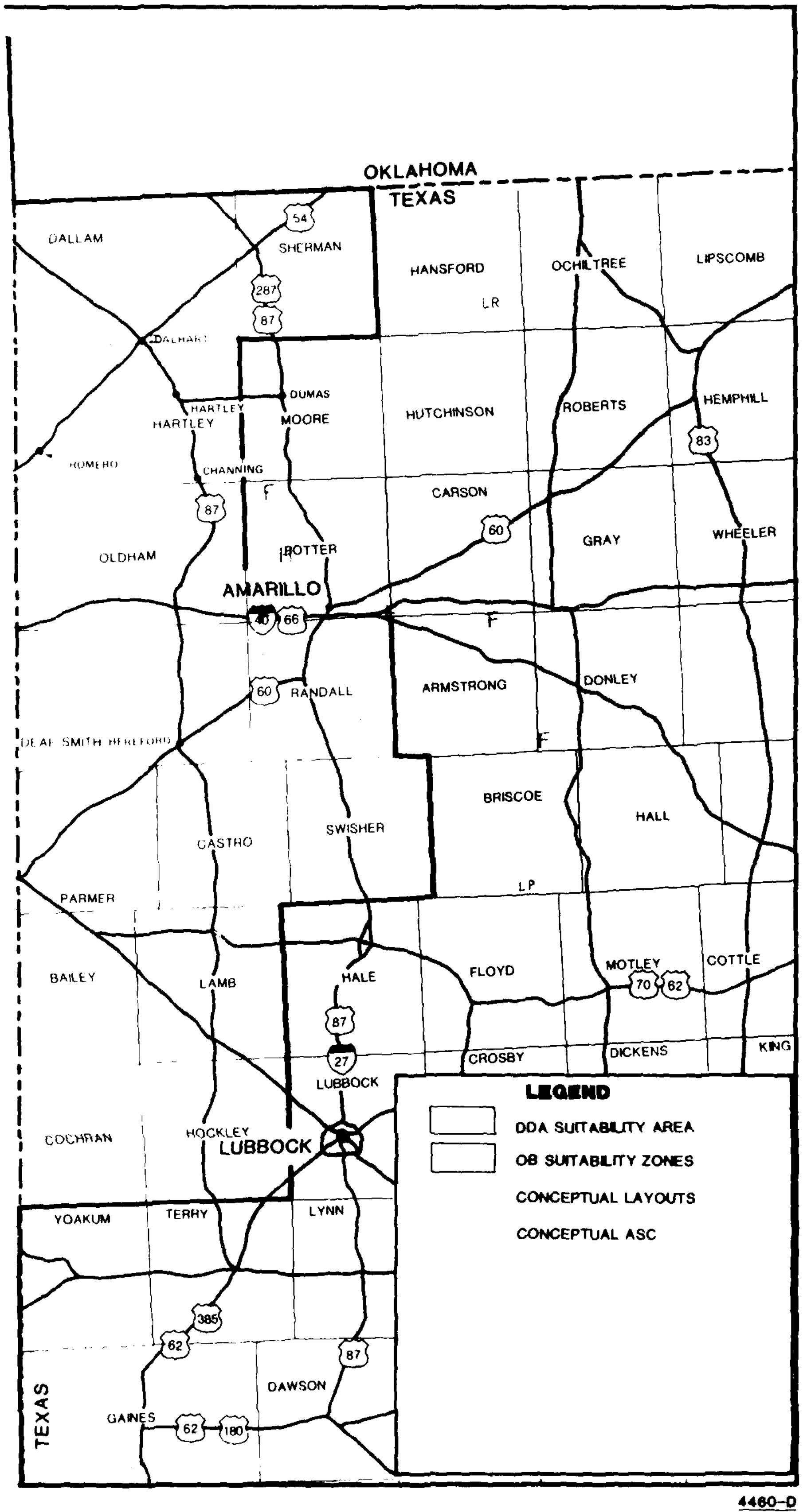


Figure 3.3.2.8-2. Distribution of protected terrestial animals in and near the Texas/New Mexico study area.

Mosquero (Figure 3.3.2.8-3). Thirteen fish and two frogs which are state protected as well as one federally protected fish (the Pecos gambusia) may occur in or near the study area (Table 3.3.2.8-1).

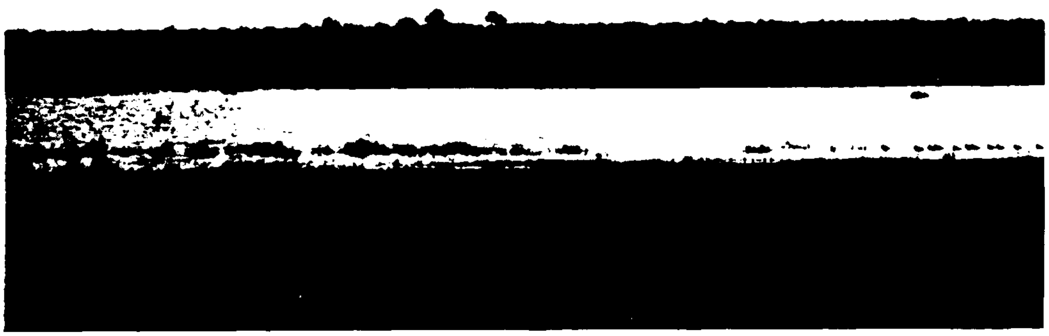
Wilderness/Natural Areas (3.3.2.9)

Wilderness/Natural Areas (3.3.2.9.1)

Wilderness resources (Figure 3.3.2.9-1) in the vicinity of the Texas/New Mexico study area include the USFWS-managed Salt Creek Wilderness within the Bitterlake National Wildlife Refuge and the BLM-managed Sabinosa Wilderness Study Area. These are located approximately 10 and 40 air miles, respectively, from the nearest project feature for both the full and split basing alternatives.

Significant Natural Areas (3.3.2.9.2)

Significant natural areas within or near the proposed Texas/New Mexico siting area are: 11 designated/proposed National Natural Landmarks, 15 wildlife refuges, five Research Natural Areas, and two National Grasslands (Figure 3.3.2.9-2). Most of these areas are protected by one or more federal agencies (Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, U.S. Forest Service). Others are state-protected or privately owned.



The Muleshoe, Texas, National Wildlife Refuge is on the central flyway and is important to migrating waterfowl.

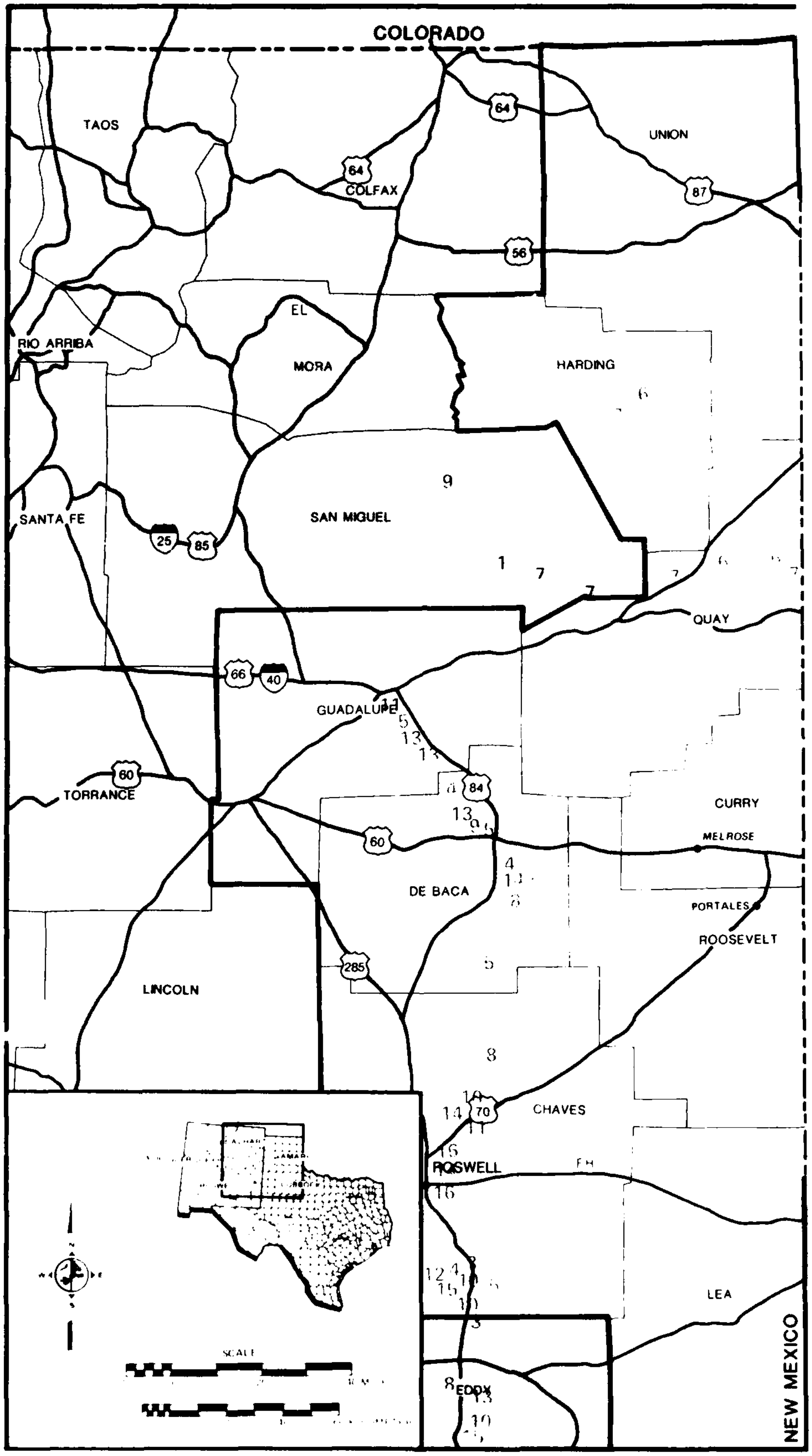
LEGEND

PROTECTED FISH SPECIES OF THE
TEXAS/NEW MEXICO M-X STUDY AREA

FISHES

1. AMERICAN EEL
2. BLUE SUCKER
3. GRAY REDHORSE
4. MEXICAN TETRA
5. ROUNDNOSE MINNOW
6. CANADIAN SPECKLED DACE
7. ARKANSAS RIVER SHINER
8. SILVERBAND SHINER
9. SUCKERMOUTH MINNOW
10. PECOS PUPFISH
11. RAINWATER KILLIFISH
12. GREENTHROAT DARTER
13. BIGSCALE DARTER
14. PECOS GAMBUSIA
15. HEADWATER CATFISH
16. BLUNTNOSE SHINER

4691-D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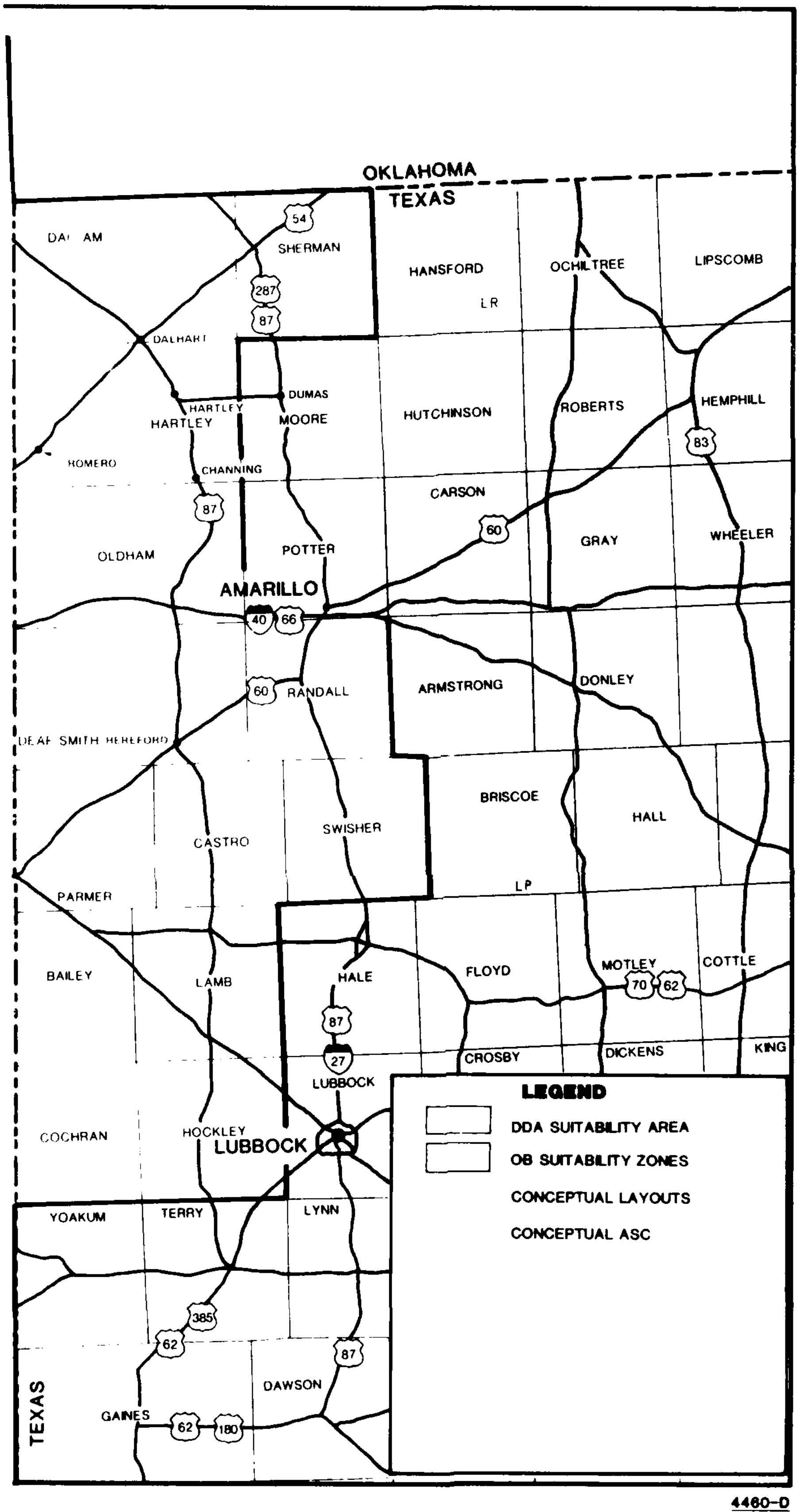
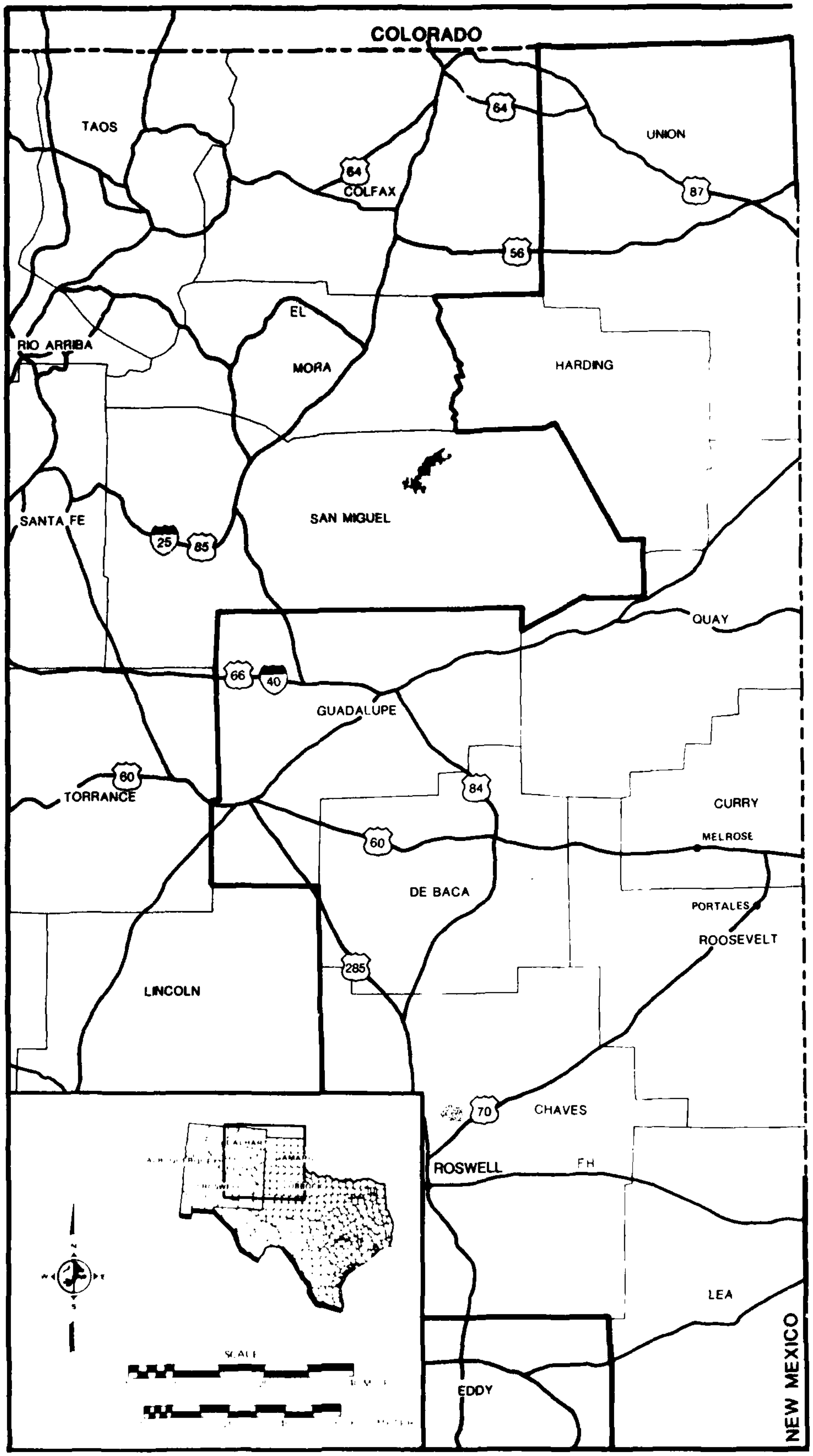


Figure 3.3.2.8-3. Distribution of protected fish in and near the Texas/New Mexico study area.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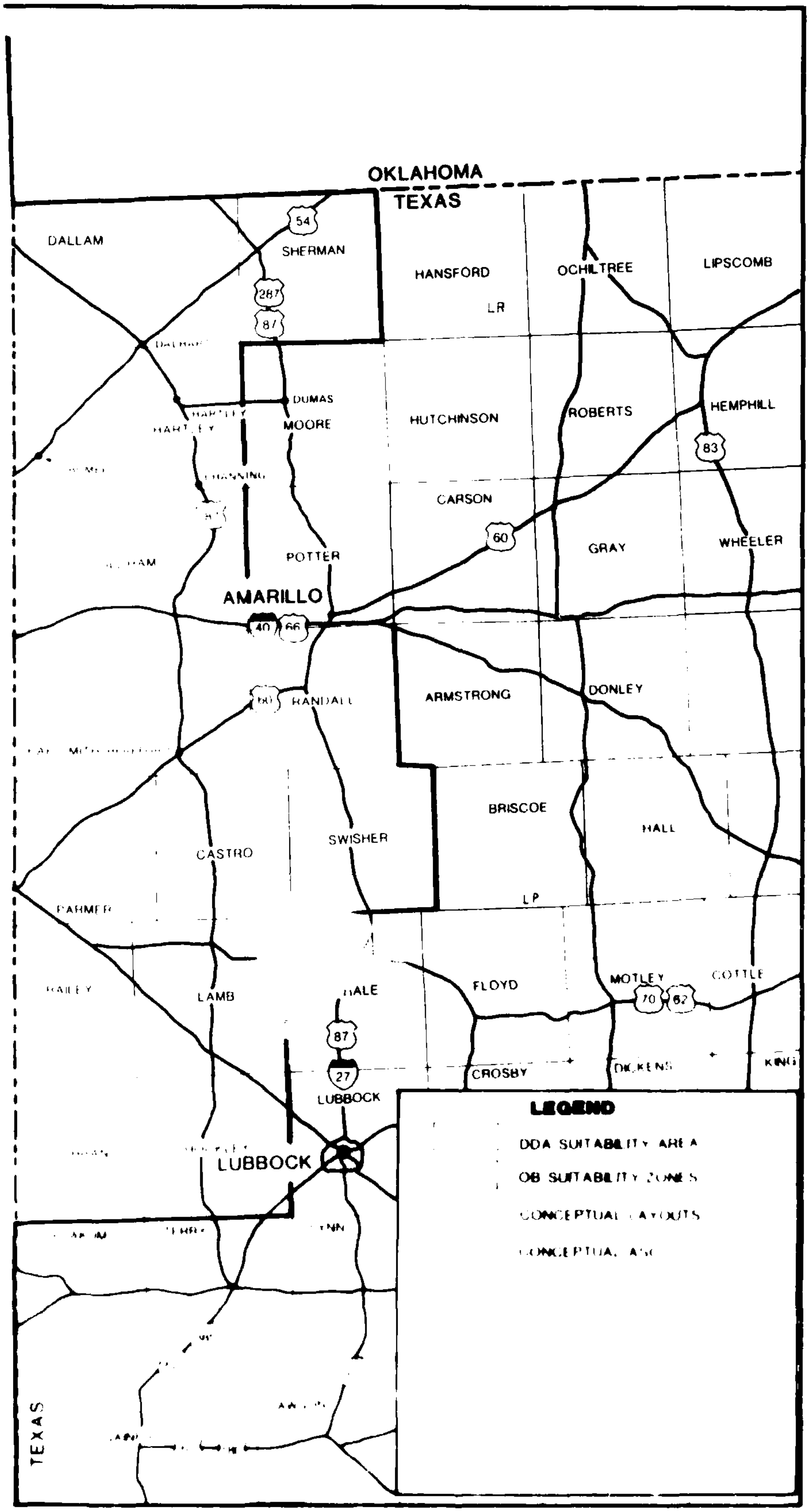
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WHEELER
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SWISHER
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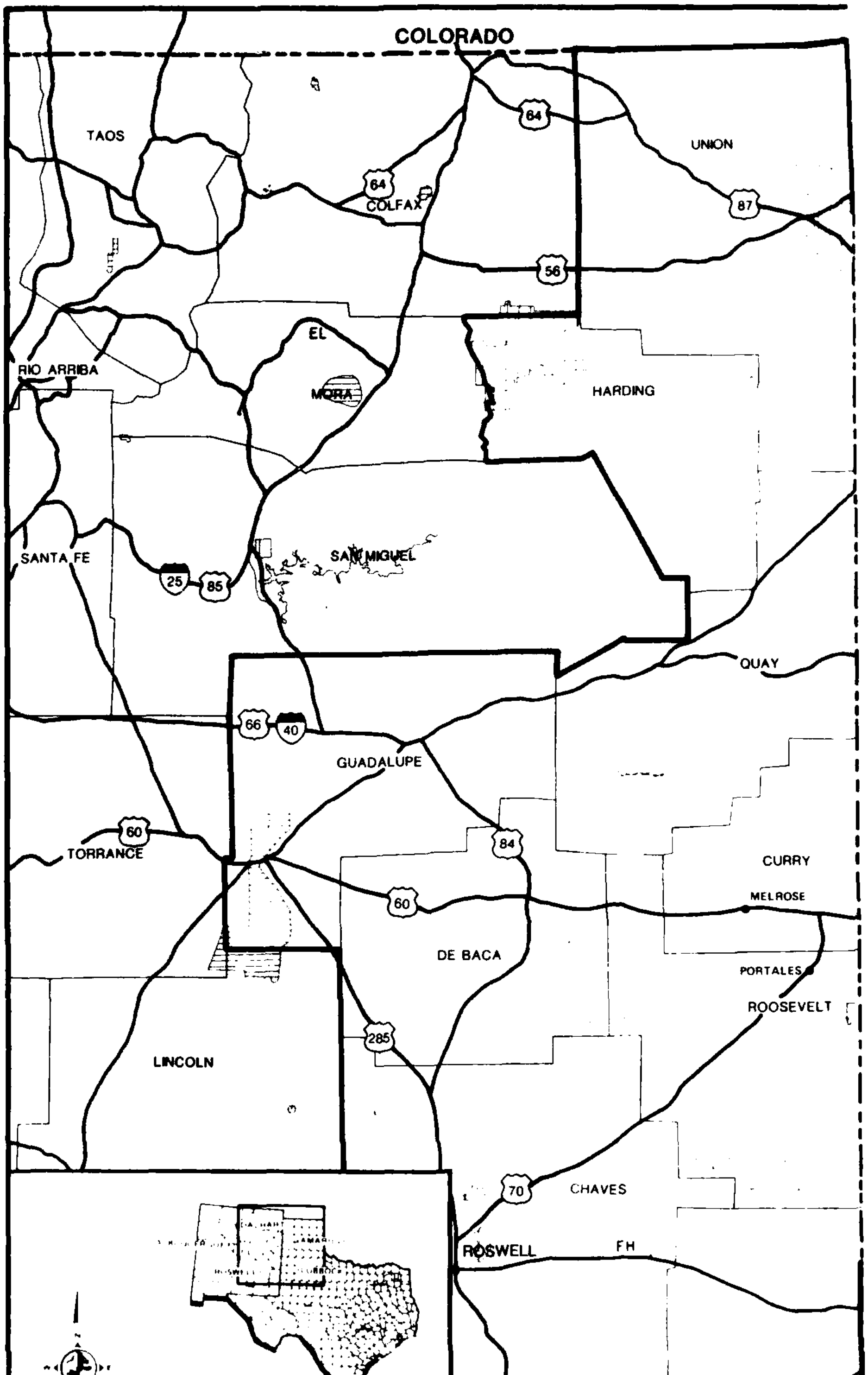

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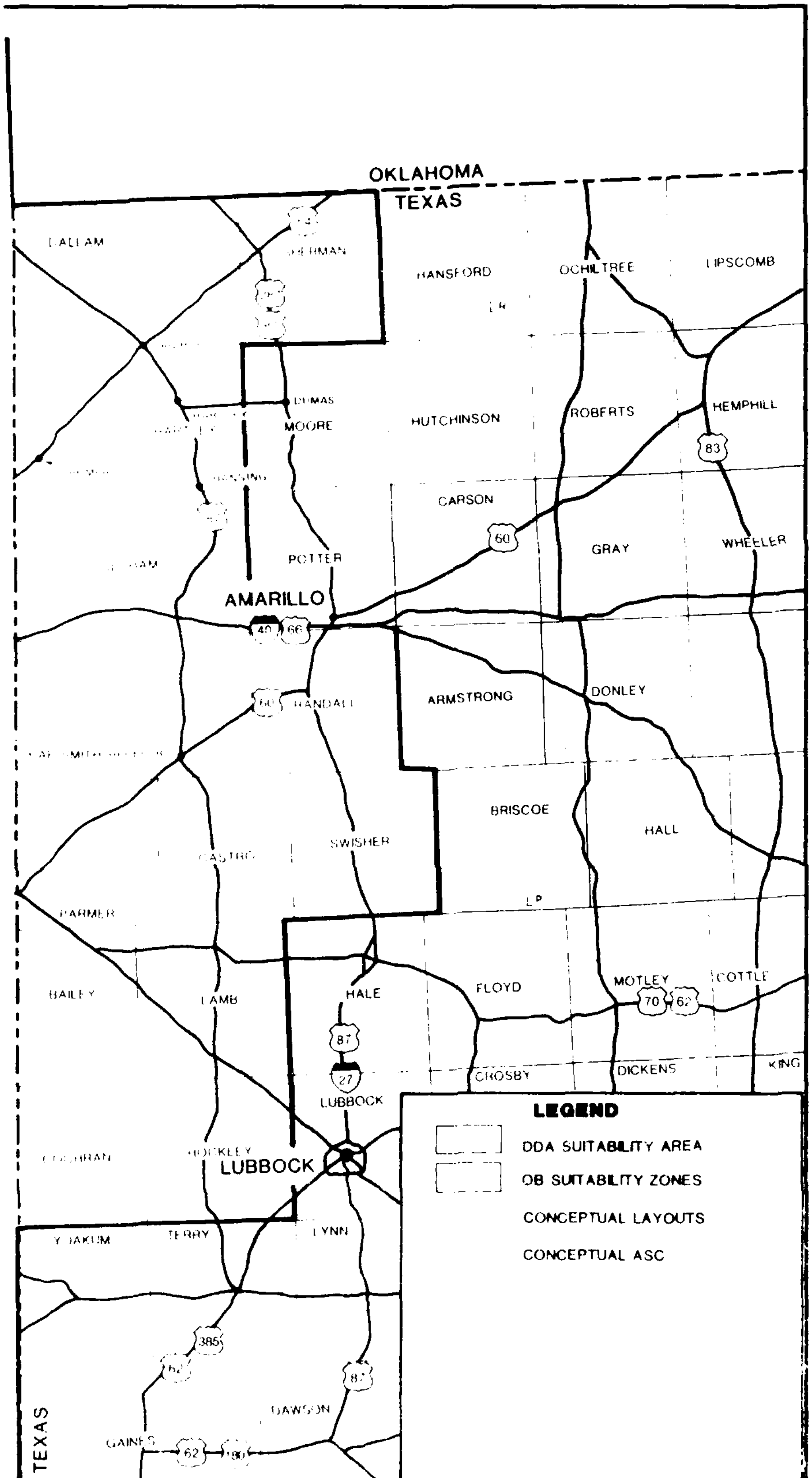
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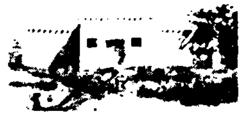
Human Environment



HUMAN ENVIRONMENT

The following sections describe important social, economic, and cultural resources in the Texas/New Mexico study area. See Figure 3.3.3-1 for the designated region of influence (ROI).

Employment and Labor Force (3.3.3.1)

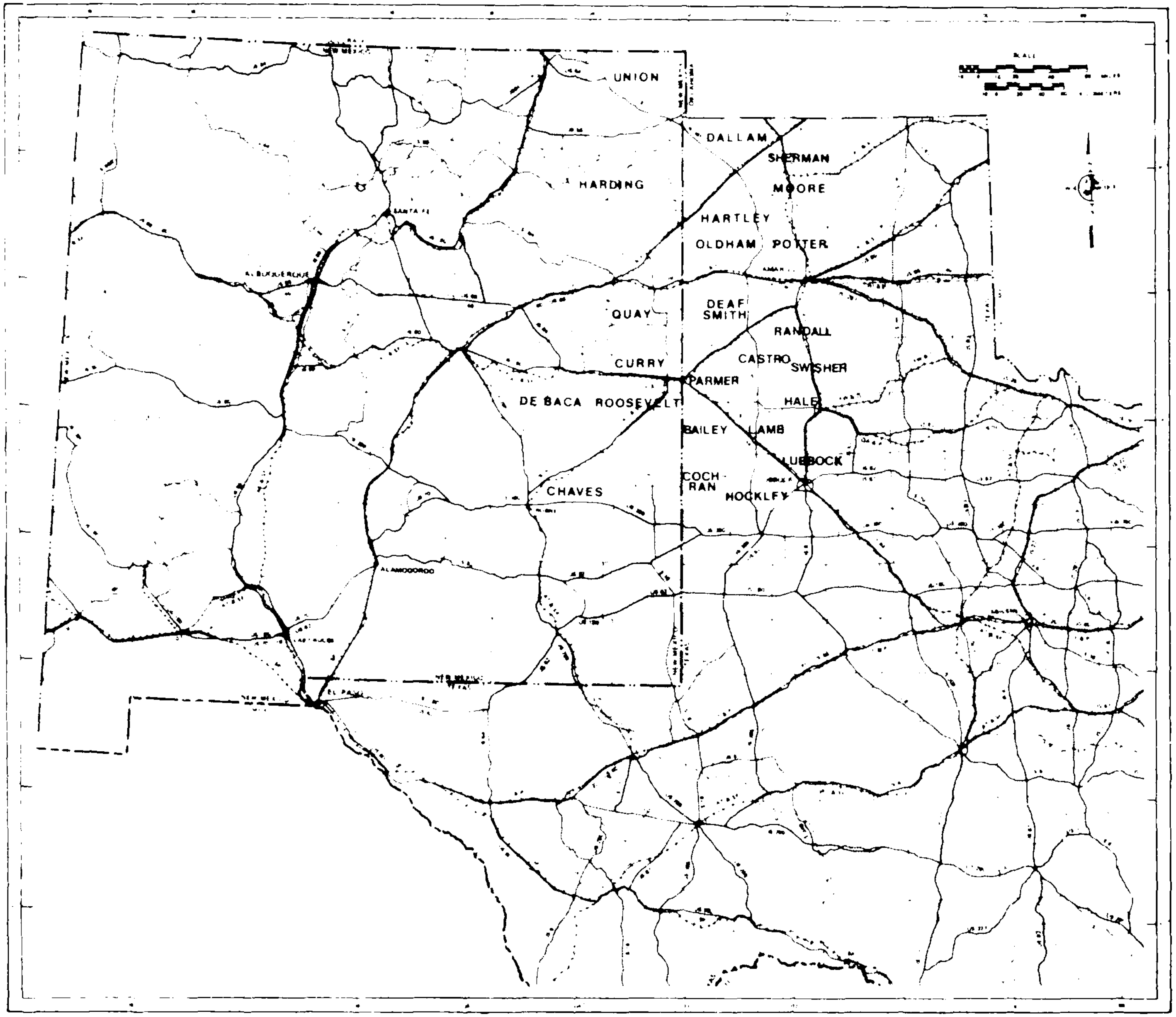
The Texas/New Mexico area is being considered as an alternate site for the deployment of the M-X system. Located in western Texas and eastern New Mexico, the region is generally known as the Southern High Plains. A detailed analysis of the employment and labor force in this region appears in Section 2.1.2 in ETR-44. The designated Texas/New Mexico region of influence (ROI) includes the Texas counties of Bailey, Castro, Cochran, Dallam, Deaf Smith, Hale, Hartley, Hockley, Lamb, Lubbock, Moore, Oldham, Parmer, Potter, Randall, Sherman, and Swisher, and the New Mexico counties of Chaves, Curry, De Baca, Harding, Quay, Roosevelt, and Union. Potential operating base sites are located in the vicinities of Clovis, New Mexico and Dalhart, Texas.

Recent Labor Force Trends (3.3.3.1.1)

Texas (3.3.3.1.1.1)

The major employment centers in Texas--Dallas, Fort Worth, Houston, and San Antonio--lie outside the 17-county Texas ROI. Within the ROI, Lubbock and Amarillo are the primary locations of employment. The Texas ROI counties had a total labor force of approximately 258,000 persons in 1980, 4 percent of the state's labor force. The Lubbock County labor force consisted of 100,000 persons in 1980, about 40 percent of the total labor force within the ROI. The Amarillo metropolitan area, consisting of Potter and Randall counties, accounted for an additional 86,000 workers. The remaining Texas ROI counties are primarily rural. Hale County is the largest of these with a labor force of about 16,000 persons in 1980. Oldham County has the smallest labor force, with about 700 persons in 1980.

The unemployment rate for the Texas ROI counties averaged 4.4 percent in 1980, significantly below the state average of 5.2 percent and the U.S. average of 7.1 percent. The 1980 average unemployment rate for the ROI was largely



SOURCE: HDR SCIENCES, BASED ON INFORMATION FROM THE DEPARTMENT OF THE AIR FORCE, BMO (AFSC), AND OTHER FEDERAL AND STATE AGENCIES (SEE ETR 27)

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Figure 3.3.3-1. The designated Texas/New Mexico region of influence (ROI) for the human environment.

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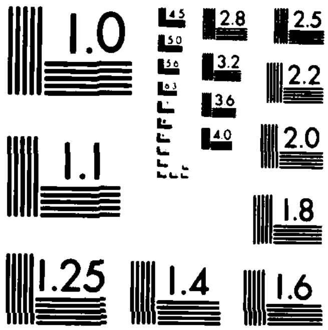
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determined by unemployment rates of 4.4 percent in Lubbock County, 5.3 percent in Potter County, and 2.7 percent in Randall County. Only Castro and Deaf Smith counties experienced unemployment rates in 1980 significantly higher than the state average, posting rates of 6.2 percent each. Hartley County had the lowest unemployment rate--2.6 percent--in the ROI in 1980.

Tables found in the baseline employment section of ETR-3B present recent historical data on population, labor force, employment, and unemployment for the 17 Texas ROI counties from 1974 through 1980. Only Lubbock, Potter, and Randall counties registered any significant labor force or employment changes during this period. The largest labor force increase from 1974 through 1980 in absolute terms occurred in Lubbock County, a rise from 87,000 in 1974 to more than 100,000 persons in 1979 and 1980. This represents an average annual labor force growth of 2.3 percent in the county, slightly above the average annual employment growth of 2.2 percent. The combined labor forces of Potter and Randall counties grew from 72,000 in 1974 to more than 86,000 in 1980, or 3.1 percent per year on the average. Employment in Potter and Randall counties grew at an average rate of 2.9 percent annually during 1974 to 1980.

Employment and labor force trends in the more rural Texas ROI counties have been negligible since 1974. In several counties--Castro, Cochran, Deaf Smith, Hockley, Lamb, Oldham, and Swisher--employment peaked in 1976-77 and has fallen since. In Dallam County, employment fell from about 2,400 persons in 1974-75 to less than 1,900 persons in 1976 and rose again to 2,400 persons in 1979-80. Unemployment rates in the Texas ROI counties averaged somewhat less than their 1980 levels throughout the 7-year period 1974-80. Only in Sherman and Oldham counties was the 1980 unemployment rate below its 1974-80 average level. Additional detail of employment and labor force trends is presented in ETR-44.

New Mexico (3.3.3.1.1.2)

The labor force in the state of New Mexico was 542,000 persons in 1980, mostly located in the metropolitan centers of Albuquerque, Santa Fe, Roswell, and Las Cruces. About 51,000 persons--9 percent of the state's labor force--were located within the 7-county ROI. Of these 51,000 workers, about 70 percent, or 35,000, resided in Chaves and Curry counties. The labor force in Harding County consisted of less than 600 persons in 1980. De Baca, Quay, Roosevelt, and Union counties had labor forces of 7,300 persons or less in 1980.

Unemployment rates in the New Mexico ROI counties in 1980 were well below the state average of 7.4 percent and the U.S. average of 7.1 percent. The average unemployment rate for the 7-county ROI was 5.3 percent in 1980. The lowest unemployment rate in the ROI was 3.1 percent in De Baca County and the highest unemployment rate was 6.2 percent in Curry County.

Tables found in the baseline employment section of ETR-3C present historical data on population, labor force, employment, and unemployment for the seven New Mexico ROI counties. These data indicate that growth in labor force and employment in the ROI was sporadic from 1968 through 1980. Of the ROI counties, labor force and employment growth were most rapid in Chaves County during 1968-80. Employment on a labor force basis in Chaves County expanded at an average annual rate of 3.2 percent from 1970 to 1980. Curry County employment grew at an average annual rate of 2.6 percent from 1968 through 1978, but fell 2.9 percent annually from 1978 through 1980. Employment in De Baca County grew more

slowly--at 2.0 percent annually from 1970 through 1980. In Harding County, no significant employment trend is observable. The number of employed persons has fluctuated from a low of 475 in 1970 to a high of 670 in 1978, falling back to 540 jobs in 1980. Quay County's employment grew at an average rate of 2.7 percent per year from 1969 through 1977, but has shown virtually no growth since then. Employment in Roosevelt County grew at a rate of 2.6 percent per year from 1968 through 1974 but since has fluctuated around its 1974 level of 7,000 jobs. In Union County, the 1980 employment level was nearly the same as 1968--about 2,000 jobs.

In all seven New Mexico ROI counties, 1980 unemployment rates are representative of average unemployment rates for the 1975-80 period. The number of unemployed workers in the ROI was the highest in 1975 when 2,500 people were out of work in Chaves and Curry counties. Unemployment levels were only slightly lower in 1976 and 1977 in these counties.

Through the first five months of 1981, unemployment rates were significantly higher in Chaves, Curry, and Quay counties compared to their 1980 levels. The Chaves County unemployment rate increased from 5.5 to 6.3 percent, the Curry County unemployment rate increased from 6.2 percent to 6.5 percent, and the Quay County unemployment rate increased from 5.4 percent to 7.3 percent. For the first five months of 1981, unemployment rates in DeBaca, Harding and Roosevelt counties were less than their 1980 levels. The unemployment rate fell in DeBaca County from 3.1 percent to 2.0 percent, in Harding County from 4.4 percent to 3.2 percent, and in Roosevelt County from 3.6 to 3.4 percent. At the same time, employment and labor force levels fell in all three of these counties, indicating that the decline in the unemployment rate was due to workers leaving the labor force rather than taking new jobs. In Union County, the unemployment rate fell slightly from 4.2 to 3.9 percent, while employment and labor force levels actually rose. Thus, only Union County in the New Mexico ROI experienced an improved employment situation in the first five months of 1981 compared to the 1980 annual average. Additional detail on employment and labor force trends is presented in ETR-44.

Projected Labor Force, Employment, and Unemployment Without M-X (3.3.3.1.2)

Baseline Projections (3.3.3.1.2.1)

Employment is projected for each ROI county on the basis of widely used population projections, and labor force and unemployment rate data published by the Texas Employment Commission and the New Mexico Department of Employment Security. This procedure is the same used in projecting employment for the Nevada/Utah region (see section 3.2.3). The county labor force participation rates and unemployment rates used in making these projections are shown in the "Projected Labor Force, Employment, and Unemployment without M-X" (2.1.2.4) section of ETR-44.

Table 3.3.3-1 presents the baseline employment forecasts, by place of residence, for the counties in the Texas/New Mexico ROI. These projections and extrapolation of employment growth trends over the 1967-1977 period indicate modest employment growth through 1994. Over the 1982-1994 period, regional employment is forecast to increase by about 39,000 jobs, to an 343,000 jobs in 1994. This represents average annual growth of 1.0 percent.

Table 3.3.3-1.

TREND-GROWTH BASELINE EMPLOYMENT PROJECTIONS, TEXAS/NEW MEXICO ROI, 1982-1994.

COUNTY	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
BAILEY	3392.	3400.	3409.	3421.	3425.	3433.	3441.	3449.	3457.	3462.	3462.	3462.	3462.
CASTRO	3991.	4013.	4034.	4060.	4078.	4099.	4121.	4142.	4167.	4185.	4207.	4228.	4250.
CHAVES	19803.	20122.	20448.	20777.	21070.	21370.	21674.	21981.	22292.	22570.	22848.	23129.	23414.
COCHRAN	2045.	2045.	2045.	2045.	2045.	2045.	2045.	2045.	2045.	2056.	2072.	2088.	2104.
CURRY	14392.	14438.	14484.	14530.	14536.	14543.	14550.	14556.	14566.	14536.	14510.	14484.	14458.
DALLAM	2347.	2374.	2402.	2432.	2456.	2484.	2511.	2539.	2569.	2607.	2648.	2689.	2730.
DEAF SMITH	8452.	8532.	8612.	8696.	8772.	8851.	8931.	9011.	9091.	9178.	9266.	9354.	9442.
DE BACA	1003.	1003.	1003.	1003.	991.	983.	976.	968.	964.	964.	964.	964.	964.
HALE	15670.	15835.	16004.	16172.	16341.	16510.	16683.	16860.	17032.	17251.	17469.	17691.	17917.
HARDING	534.	524.	514.	509.	494.	484.	473.	463.	453.	433.	412.	392.	372.
HARTLEY	1159.	1184.	1210.	1235.	1261.	1286.	1311.	1337.	1362.	1388.	1413.	1438.	1464.
HOCKLEY	8987.	9044.	9101.	9163.	9224.	9289.	9355.	9420.	9490.	9543.	9600.	9658.	9715.
LAMB	7129.	7121.	7113.	7109.	7109.	7109.	7109.	7109.	7109.	7097.	7089.	7081.	7073.
LUBBOCK	99579.	100999.	102441.	103897.	105082.	106280.	107492.	108717.	109956.	111204.	112465.	113740.	115029.
MOORE	6564.	6591.	6618.	6649.	6681.	6717.	6753.	6789.	6825.	6870.	6914.	6959.	7004.
OLDHAM	853.	859.	865.	871.	884.	896.	909.	921.	937.	953.	971.	990.	1009.
PARMER	4233.	4233.	4233.	4233.	4237.	4245.	4254.	4262.	4274.	4303.	4336.	4369.	4402.
POTTER/RANDALL	82304.	83311.	84334.	85367.	86360.	87362.	88380.	89413.	90455.	91542.	92643.	93760.	94891.
QUAY	4856.	4864.	4873.	4882.	4873.	4864.	4856.	4847.	4843.	4821.	4804.	4786.	4769.
ROOSEVELT	6864.	6889.	6913.	6942.	6971.	7004.	7037.	7070.	7108.	7137.	7170.	7203.	7236.
SHERMAN	1553.	1561.	1569.	1577.	1585.	1593.	1601.	1610.	1622.	1634.	1650.	1666.	1683.
SWISHER	4498.	4515.	4532.	4554.	4583.	4617.	4651.	4686.	4720.	4771.	4822.	4873.	4924.
UNION	2128.	2119.	2111.	2106.	2111.	2119.	2128.	2137.	2150.	2150.	2150.	2150.	2150.
DEPLOYMENT REGION	302335.	305576.	308866.	312229.	315166.	318185.	321239.	324329.	327485.	330652.	333884.	337153.	340459.

SOURCE HDR SCIENCES, BASED ON POPULATION, LABOR FORCE, AND UNEMPLOYMENT DATA FROM STATE SOURCES.

CT

From 1982-1994, Texas's share of the total is forecast to increase slightly, from 83.9 percent of total ROI employment in 1982 to 84.7 percent by 1994. As indicated in the table, not all counties are projected to grow. Lamb, De Baca, Harding, and Quay counties are all forecast to experience minor employment loss. On the other hand, the counties of Lubbock and Potter/Randall, with well developed economies, are forecast for slightly more rapid growth.

Major Non-M-X Developments in the Texas/New Mexico ROI (3.3.3.1.2.2)

Trend-growth projections include continuation of recent growth trends and some local industrial expansion. Many energy-related projects are also slated for the region during the forecast period, however the combined effect of these projects is not expected to be great enough to significantly alter the trend-growth projections in Table 3.3.3-1. The largest of these energy-related projects (including one highway improvement plan) are:

- Tolk 1 and Tolk 2 Power Plants
- Interstate 27
- Amoco CO_2 Pipeline
- Shell-Mobil CO_2 Pipeline
- Arco CO_2 Pipeline

A description of these projects, including projected employment levels during the construction and operations phases, appears in the "Projected Labor Force, Employment and Unemployment without M-X" (2.1.2.4) section of ETR-44.

Table 3.3.3-2 summarizes the adjustments made to the baseline projections of the University of New Mexico's Bureau of Business and Economic Research and the Texas State Water Board due to effects of major non-M-X projects.

Comparison of Alternative Projections (3.3.3.1.2.7)

Employment, as shown in Table 3.3.3-1, is projected to grow quite slowly through 1994. This growth is expected to be significantly below the average projected for the two states of Texas and New Mexico as well as below the average projected for the United States. Table 3.3.3-3 summarizes the employment growth rates projected in this analysis, and compares them to projections by Chase Econometrics for the two-state area and the United States.

From 1974 to 1980, employment on a labor force basis in the 24-county Texas/New Mexico ROI grew at an average annual rate of 1.8 percent. During the same years, the two states of Texas and New Mexico experienced employment growth on a labor force basis of 3.5 percent per year. At the same time, U.S. employment grew at an average annual rate of 2.1 percent.

During 1982-85, employment on a labor force basis in the Texas/New Mexico ROI counties is projected to grow at an average annual rate of 1.1 percent. For the two states of Texas and New Mexico, employment is projected to grow at an average annual rate of 3.3 percent, while U.S. employment is projected to grow 2.6 percent per year. Employment in the Texas/New Mexico ROI during 1985-90 is projected to grow at an average annual rate of 1.0 percent, compared to a projected rate of 2.5 percent for the two-state area, and 1.7 percent for the United States as a whole.

Table 3.3.3-2. Adjustments to baseline population projections to account for major non-M-X projects, Texas/New Mexico deployment regions (Page 1 of 2).

County and Project	1982	1983	1984	1985
Lamb County, TX				
Trend-growth Baseline	17,400	17,400	17,400	17,400
Impact of Tolk 1 and 2	100	100	100	100
High-growth Baseline	17,500	17,500	17,500	17,500
Curry County, NM				
Trend-growth Baseline	43,870	44,010	44,150	44,290
Impact of Amoco	--	660	660	--
Impact of Arco	660	660	--	--
High-growth Baseline	44,530	45,330	44,810	44,290
Harding County, NM				
Trend-growth Baseline	1,050	1,030	1,010	1,000
Impact of Amoco	--	15	15	--
High-growth Baseline	1,050	1,045	1,025	1,000
Quay County, NM				
Trend-growth Baseline	11,230	11,250	11,270	11,290
Impact of Amoco	--	170	170	--
Impact of Arco	170	170	--	--
High-growth Baseline	11,400	11,590	11,440	11,290
Roosevelt County, NM				
Trend-growth Baseline	16,610	16,670	16,730	16,800
Impact of Amoco	--	250	250	--
Impact of Arco	250	250	--	--
High-growth Baseline	16,860	17,170	16,980	16,800

T3922/9-16-81/F

Table 3.3.3-2. Adjustments to baseline population projections to account for major non-M-X projects, Texas/New Mexico deployment regions (Page 2 of 2).

County and Project	1982	1983	1984	1985
Union County, NM				
Trend-growth Baseline	4,850	4,830	4,810	4,800
Impact of Amoco	--	70	70	--
Impact of Arco	70	70	--	--
Impact of San Marco	--	--	--	--
High-growth Baseline	4,920	4,970	5,380	5,550

T3922/9-16-81/F

Sources: Trend-growth projections are from the Texas State Water Board and the University of New Mexico, Business of Economic and Business Research. Impact estimates and high-growth projections have been calculated by HDR Sciences, October 1980.

Note: Only in Lamb County, Texas, do the changes shown persist through the entire projection period (through 1994). For the other counties shown, no adjustments are made to the trend-growth baseline from 1986 through 1994.

Table 3.3.3-3 Projected average annual employment growth rates, Texas/New Mexico ROI, Texas/New Mexico two-state area, and United States (percent).

	1974-80	1982-85	1985-90	1990-94
EIS - ROI	1.8	1.1	1.0	1.0
Chase				
Two-state area	3.5	3.3	2.5	n.a.
United States	2.1	2.6	1.7	n.a.

T5528/9-11-81

Sources: For EIS projections, HDR Sciences calculations, based on data provided by the Texas State Water Board, the University of New Mexico, Bureau of Business and Economic Research, the Texas Employment Commission, and the New Mexico Department of Employment Security. For the Chase Econometrics projections, the Chase regional long-term forecast of first quarter 1981, and the U.S. long-term standard-trend forecast of second quarter 1981.

In summary, the Texas/New Mexico ROI is expected to remain predominantly rural with relatively slow growth compared to the United States. The growth which is projected is anticipated for the metropolitan areas of Amarillo and Lubbock. Chaves County is also expected to experience above-average growth. The small rural counties are projected to retain their rural nature without M-X, with relatively little employment change through 1994.

Income and Earnings (3.3.3.2)

This section presents baseline income and earnings data for the ROI counties in Texas and New Mexico. Detailed baseline earnings data by major industrial sector for the ROI counties as well as the states can be found in Environmental Technical Report Numbers 3A-3C.

Texas

Total earnings in Texas amounted to approximately $92.4 billion in 1979, while aggregate personal income reached $117.5 billion in that year. Earnings in manufacturing represent the single largest source, accounting for about 19.9 percent of total labor and proprietor income in 1979. Service-sector and government-sector earnings are the next in importance.

The ROI counties comprise a very small portion of the Texas economy, representing only 3.8 percent of the total 1979 personal income received in the state. Potter, Randall, and Lubbock counties are the only counties in the ROI that have experienced steady growth in income per capita (Table 3.3.3.2-1). In the remaining counties, the wide year-to-year variances are attributable to fluctuating farm proprietor income.

Table 3.3.3.2-2 presents wage and salary earnings per worker for the ROI counties, the state of Texas and the United States. For the majority of county areas, wage and salary earnings per worker in the ROI counties were substantially below the state and national levels.

Texas aggregate personal income in real terms is projected by Chase Econometrics to increase at an average annual rate of 2.8 percent during 1980-85 and 2.9 percent from 1985 to 1990. This represents slightly more rapid growth than projected for U.S personal income--2.4 percent for 1980-85 and 2.6 percent during 1985-90.

New Mexico

Total earnings (labor and proprietor income on a place of work basis) in New Mexico amounted to approximately $7.1 billion in 1979. While no one sector dominates the New Mexico economy, earnings originating in the government sector account for the single largest source, approximately 25.7 percent of total earnings in the state in 1979. The services, retail trade, and mining sectors are the other major earnings sources in the state.

Table 3.3.3.2-3 presents personal income per capita for the counties in the New Mexico ROI, the state, and the United States. Per capita income levels for the state and the ROI are substantially below the U.S. average with the exception of the 1978 and 1979 figures for Union County.

Table 3.3.3.2-1. Personal income per capita, selected counties, State of Texas, and United States, 1969-1979 (current dollars).

County	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Bailey	2,872	3,291	2,430	3,264	5,498	4,782	5,156	4,191	6,158	6,579	8,355
Castro	3,636	4,976	4,131	4,061	5,815	4,543	7,139	5,783	6,245	6,052	7,348
Cochran	2,117	3,343	3,149	2,780	2,595	3,428	3,153	2,781	5,302	4,297	6,276
Dallam	4,175	3,407	3,836	3,204	4,820	3,308	5,155	5,272	8,212	7,812	8,267
Deaf Smith	4,448	5,411	4,610	5,105	5,677	4,432	7,635	6,158	8,533	8,436	8,598
Hale	2,581	3,673	3,651	3,691	5,218	4,614	5,204	5,914	6,901	6,490	8,019
Hartley	4,771	1,104	2,347	5,048	7,047	2,384	4,323	3,536	8,607	5,469	3,859
Hockley	2,571	3,052	2,804	2,960	4,314	3,785	4,169	4,635	6,745	5,558	7,285
Lamb	2,697	3,568	3,141	3,207	4,418	4,318	5,507	5,748	7,236	6,536	8,506
Lubbock	2,964	3,355	3,420	3,723	4,324	4,724	5,120	5,762	6,642	7,220	8,143
Moore	3,848	4,448	3,213	3,149	3,723	4,482	5,272	6,245	7,698	7,027	7,453
Oldham	2,845	2,923	1,063	3,222	4,491	1,555	4,658	2,187	3,033	6,853	5,141
Parmer	5,241	6,341	3,864	2,147	6,288	4,623	7,887	5,902	5,526	4,874	5,978
Potter	2,972	3,562	4,046	4,205	4,722	5,552	6,279	6,927	7,786	8,802	9,747
Randall	3,449	3,752	3,955	4,047	4,613	4,867	5,952	6,666	7,189	8,016	8,670
Sherman	5,372	5,386	4,943	2,866	5,979	4,035	7,984	4,825	9,105	6,657	5,980
Swisher	3,786	4,803	4,103	4,203	6,277	4,524	6,460	5,438	7,542	7,297	8,057
Texas	3,275	3,507	3,700	4,053	4,525	5,041	5,583	6,175	6,911	7,784	8,778
United States	3,667	3,893	4,132	4,493	4,981	5,428	5,861	6,401	7,035	7,846	8,757

T5109/9-2-81

Source: U.S. Dept. of Commerce, April 1981.

Table 3.3.3.2-2. Wage and salary earnings per worker, selected counties, State of Texas, and United States, 1974-1979 (current dollars).

County	1974	1975	1976	1977	1978	1979
Bailey	5,401	5,727	6,221	7,023	8,081	9,132
Castro	5,189	5,589	6,306	6,825	7,737	8,247
Cochran	5,113	5,467	5,801	6,523	6,642	7,909
Dallam	5,836	6,242	7,050	7,966	8,687	9,751
Deaf Smith	6,150	6,858	7,435	7,999	8,893	9,568
Hale	6,345	6,757	7,310	7,865	8,501	9,369
Hartley	5,031	5,006	5,490	6,356	6,815	7,895
Hockley	7,041	7,675	8,392	9,280	10,317	11,203
Lamb	5,133	5,687	6,477	6,866	7,638	8,617
Lubbock	7,360	7,917	8,560	9,008	9,800	11,122
Moore	7,584	8,273	9,532	10,146	11,307	12,593
Oldham	5,523	6,224	6,618	7,206	8,008	9,199
Parmer	5,481	5,820	6,363	6,948	7,704	9,036
Potter	7,881	8,733	9,531	10,229	11,204	12,400
Randall	6,700	7,636	8,064	8,407	9,481	10,116
Sherman	5,408	5,768	6,339	7,061	7,397	8,233
Swisher	5,340	5,711	6,149	6,593	7,115	8,046
Texas	8,185	8,947	9,751	10,510	11,551	12,771
United States	8,909	9,571	10,283	10,986	11,855	12,884

T5110/9-2-81

Source: U.S. Dept. of Commerce, April 1981.

Table 3.3.3.2-3. Personal income per capita, selected counties, State of New Mexico, and United States, 1969-1979 (current dollars).

County	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Chaves	2,829	2,956	3,141	3,335	3,831	4,168	4,795	5,202	5,495	6,389	7,121
Curry	3,191	3,742	3,613	3,931	4,610	4,697	5,015	5,346	5,825	7,047	7,256
DeBaca	2,603	2,773	3,012	3,708	4,217	3,611	4,479	4,729	4,985	5,879	6,899
Harding	2,619	2,922	2,606	2,982	3,621	2,452	4,041	3,920	3,926	5,625	6,467
Quay	2,399	2,906	2,858	3,288	3,957	4,031	4,473	4,298	4,679	6,055	6,492
Roosevelt	2,658	2,842	2,941	3,101	3,733	3,152	4,533	4,605	4,889	5,731	6,539
Union	3,055	4,688	4,229	4,458	5,443	4,505	6,747	4,126	4,495	8,377	10,912
New Mexico	2,820	3,063	3,287	3,585	3,950	4,326	4,835	5,319	5,921	6,757	7,483
United States	3,667	3,893	4,132	4,493	4,981	5,428	5,861	6,401	7,035	7,846	8,757

T5111/9-2-81

Source: U.S. Dept. of Commerce, April 1981; New Mexico Dept. of Employment Security.

Wage and salary earnings per worker for the ROI counties are presented in Table 3.3.3.2-4. Wage and salary earnings per worker in 1979 ranged from $8,347 in Union County to $10,675 in Curry County, with a state average of $11,658. For the ROI counties and the state as a whole, earnings per worker fall below the U.S. average.

Chase Econometrics projects statewide growth in aggregate real personal income in New Mexico of 2.5 percent annually for 1980-85, and 3.1 percent annually for 1985-90. These growth rates are slightly above those projected for the United States.

Public Finance (3.3.3.3)

Texas

Historical revenues and expenditures for the state of Texas are presented in Table 3.3.3.3-1 and Table 3.3.3.3-2. Total revenues amounted to $9.4 billion in 1979-80 for an average annual rate of growth of 17.5 percent since 1974-75. The revenue structure of the state is balanced, with no single revenue source accounting for more than 25 percent of the total. Sales tax revenues account for a large share of total revenues (23.6 percent) and have grown at an annual average rate of 19.8 percent, slightly higher than the 17.5 percent registered by total revenues. Revenue from natural gas production, oil production and regulation, and gasoline sales comprised 18.8 percent of total state revenue. The largest revenue source is federal funds, which at $2.6 billion, accounted for 24.6 percent of state revenues.

Expenditures for the state of Texas amounted to approximately $10.2 billion in 1979-80 for a growth rate of 9.3 percent from 1974-75 to 1979-80. Much of this increase is due to education expenditures which accounted for almost one-half of total state expenditures. Social service outlays (health, safety, and welfare expenditures) were the second largest expenditure category at approximately $2.4 billion, or 23.2 percent of total expenditures. Education and social service outlays account for nearly three-quarters of the state's total expenditures in 1979-80.

New Mexico

Revenues and appropriations for the state of New Mexico are presented in Tables 3.3.3.3-3 and 3.3.3.3-4. Revenues accruing to the state of New Mexico are distributed over several major sources, though not as evenly as in Texas. General and selective sales taxes account for 42.5 percent of the $883 million general fund revenues. No other revenue source comprises more than 16.4 percent of the total. Total revenues grew at a rate of 21.2 percent annually between 1974-75 and 1979-80.

Public school support outlays account for the largest single appropriation category at 50.1 percent of total appropriations in 1979-80. Total education-related appropriations amount to $525 million, or 70.1 percent of general fund appropriations. General fund appropriations increased at an annual average growth rate of 20.1 percent between 1974-75 and 1979-80.

Table 3.3.3.2-4. Wage and salary earnings per worker, selected counties, State of New Mexico, and United States, 1974-1979 (current dollars).

County	1974	1975	1976	1977	1978	1979
Chaves	6,301	6,936	7,611	8,108	8,894	9,675
Curry	7,470	8,029	8,563	9,053	9,854	10,675
DeBaca	5,812	6,050	6,487	6,878	7,522	8,382
Harding	5,541	5,980	6,749	6,903	7,788	8,927
Quay	6,054	6,419	6,916	7,409	8,403	9,700
Roosevelt	5,713	6,413	7,149	7,619	8,532	9,418
Union	5,384	5,903	6,561	6,749	7,804	8,347
New Mexico	7,789	8,505	9,156	9,851	10,719	11,658
United States	8,909	9,572	10,283	10,986	11,855	12,884

T5112/9-2-81

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, April 1981.

Table 3.3.3.3-1. Summary of revenues, all funds, state of Texas, FY 1975 - FY 1980 (millions of dollars).

Revenue Source	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Major Taxes:						
Sales Tax	1,266.6	1,478.4	1,689.0	2,023.7	2,174.3	2,521.4
Natural Gas Production Tax	259.6	364.6	474.3	517.8	554.4	734.2
Motor Fuels Taxes	395.2	427.3	444.1	477.7	489.5	480.1
Oil Production and Regulation Taxes	404.8	431.3	428.5	437.2	466.7	785.7
Motor Vehicle Sales and Rental Taxes	202.6	270.5	328.1	401.1	433.3	437.9
Cigarette and Tobacco Taxes	260.4	279.3	287.8	299.8	309.3	321.8
Corporation Franchise Tax	166.6	213.6	236.9	264.9	293.8	340.8
Alcoholic Beverage Tax	119.2	131.1	151.1	164.1	181.6	200.5
Insurance Company Taxes	97.3	111.4	127.4	147.4	166.5	176.1
Utility Taxes	42.8	56.7	82.0	93.0	103.7	111.5
Inheritance Tax	47.9	58.4	66.6	79.1	73.7	75.6
Telephone Tax	30.6	35.0	39.7	44.8	52.4	59.8
Ad Valorem (Property) Tax	44.9	36.7	42.8	44.6	49.2	47.4
Other Taxes	29.2	19.6	21.9	37.1	41.9	50.5
Sub-Total	3,367.0	3,913.0	4,419.9	5,032.3	5,390.3	6,343.8
Other Major Revenue Sources:						
Federal Funds	1,531.8	1,799.7	1,878.3	2,052.9	2,299.7	2,627.9
Interest Income	228.9	242.4	290.8	352.1	438.9	536.5
Licences and Fees	317.7	339.5	374.1	414.5	408.2	478.0
Land Income: Rent, Royalties, and Sales	183.2	246.5	341.1	405.1	377.5	550.5
Other Revenue Sources	61.1	58.0	63.1	60.4	74.2	124.3
Sub-Total	2,322.8	2,686.1	2,947.5	3,285.0	3,598.6	4,317.1
Total Net Revenue	5,690.5	6,600.0	7,367.4	8,317.3	8,988.9	10,660.9

T5417/9-23-81/F

Source: Texas Comptroller of Public Accounts.

Table 3.3.3.3-2. Summary of expenditures, all funds, state of Texas, FY 1975-FY 1980 (millions of dollars).

Revenue Source	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Administrative	138.6	168.3	183.2	223.6	237.2	287.4
Services						
Welfare	929.6	1,090.7	1,217.9	1,334.9	1,509.2	1,601.3
MHMR, State Homes and Corrections	266.9	327.5	397.5	430.0	454.6	513.6
Health and Sanitation	98.8	134.2	131.1	136.2	137.7	153.7
Law Enforcement	62.3	74.7	83.2	86.5	90.3	103.4
Sub-Total	1,357.5	1,627.1	1,829.6	1,987.6	2,191.9	2,372.0
Improvements						
Highway Maintenance and Construction	831.8	731.2	661.7	921.8	1,019.8	1,580.9
Natural Resources	55.1	63.8	70.6	81.4	86.3	94.3
Parks and Monuments	48.0	61.8	49.8	45.4	48.0	59.4
Sub-Total	934.8	856.6	782.1	1,048.6	1,154.1	1,734.6
Education	2,560.7	3,099.8	3,285.2	3,999.1	4,322.4	5,045.0
Other Expenditures	385.8	451.8	526.9	605.2	694.6	771.9
Total Net Expenditures	5,377.3	6,201.5	6,607.0	7,864.1	8,600.2	10,210.9

T5418/8-29-81

Source: Texas Comptroller of Public Accounts.

Table 3.3.3.3-3. Summary of general fund receipts in support of appropriations, state of New Mexico (thousands of dollars).

Receipts	1975	1976	1977	1978	1979	1980
General and Selective Sales Taxes	209,045	233,462	257,929	306,529	335,492	375,455
Income Taxes	74,919	81,695	56,126	77,374	109,063	93,118
Severance Taxes	31,278	36,744	44,818	51,910	58,479	86,951
License Fees	4,863	4,220	5,390	6,228	6,068	9,195
Other Taxes	12,508	12,965	16,014	15,524	16,407	18,732
Interest Earnings	37,957	43,334	47,518	53,484	81,994	118,388
Rents and Royalties	30,827	34,729	61,062	72,560	91,483	144,961
Miscellaneous Receipts	3,499	4,517	4,887	5,496	5,566	9,500
Total Revenue	404,896	451,666	493,344	589,105	704,552	856,367
Reversions	3,862	13,838	4,642	7,171	7,422	10,977
Federal Revenue Sharing	13,201	13,380	14,402	16,230	16,913	15,717
Other Receipts	6,910	0	8,592	8,311	1,904	0
Total Receipts	428,869	478,884	520,980	620,817	730,791	883,061

T5419/8-21-81

Source: New Mexico Dept. of Taxation and Revenue.

Table 3.3.3.3-4. Summary of ongoing general fund appropriations, state of New Mexico (thousands of dollars).

Appropriations	1975	1976	1977	1978	1979	1980
Legislative	3,071	2,565	3,175	3,000	3,280	3,317
Judicial	9,318	11,260	13,258	15,467	17,371	20,617
General Control	17,441	23,377	25,622	27,354	34,322	35,272
Commerce, Industry and Regulation	4,275	4,942	5,577	6,472	6,984	8,407
Agriculture, Energy and Natural Resources[1]	4,740	6,301	14,478	10,378	8,852	12,615
Health, Hospitals and Human Services	48,876	59,451	62,713	77,384	89,874	101,051
Public Safety	14,141	17,246	20,507	24,751	27,842	35,246
Other Education	7,522	8,448	10,685	14,234	16,519	17,775
Higher Education	62,549	74,043	87,761	102,206	118,822	131,815
Public School Support	201,337	234,022	262,794	299,271	344,021	375,043
Transportation	0	0	2,500	7,393	5,300	7,092
Total Ongoing Appropriations	373,270	441,655	509,070	587,910	673,187	748,250

T5420/8-21-81

[1] Prior to 1977, only appropriations for natural resources included in this category.

Source: New Mexico Dept. of Taxation and Revenue.

Population and Housing (3.3.3.4)

Population and Communities (3.3.3.4.1)

The region of influence (ROI), located in the high plains area of western Texas and eastern New Mexico, contains the Amarillo and Lubbock metropolitan areas. The predominant pattern of population distribution, however, is one of rural counties with a number of widely separated small cities and towns which function as agricultural and commercial centers. The largest population centers (excluding Amarillo and Lubbock) are Clovis and Roswell in New Mexico, and Plainview in Texas. Population densities within the 24-county bistate region vary considerably: for example, Harding has less than one person per sq mi, while the easternmost metropolitan Texas counties have up to 200 persons per sq mi.

The population of the 24-county ROI was 690,592 in 1980, an increase of 83,800 persons or 13.8 percent since 1970 (see Table 3.3.3.4-1). Although the annual growth rate of 1.3 percent was slightly above that of the United States, the counties comprising the ROI grew at only about one-half the pace of the states of Texas and New Mexico. About 56 percent of the region's population lived in the two metropolitan areas. Another 19 percent was in the counties containing the cities of Plainview, Clovis, and Roswell, with the remaining 25 percent spread among the 18 rural counties. Rural areas within the ROI (with several exceptions) continued to grow more slowly during the 1970s than the urban communities, with the six urban counties accounting for 90 percent of the region's total population expansion. Five of the seven New Mexico counties and four of the seventeen in Texas actually lost population during the decade. The very slow growth in a number of other counties indicates continued net out-migration.

Projections of future population show a continuation of the pattern of slow growth, with a one percent annual rate of increase forecasted during the next decade. The 24-county region's population is forecasted to reach just over 750,000 by 1990, a net addition of about 70,900 residents during the decade (see Table 3.3.3.4-2).

Texas

The population of the 17-county Texas portion of the ROI expanded at an annual rate of 1.4 percent during the 1970s, reaching a population of 562,900 by 1980. About 75 percent of the population in 1980, and 88 percent of the growth during the past decade, was in the four most urban counties--Lubbock, Potter, and Randall (Amarillo), and Hale (Plainview). Population changes during the decade ranged from growth of 43.3 percent in Hartley (Dalhart) to a loss of 13.2 percent in Sherman County. Many of the rural counties continued to experience net out-migration, although at lesser rates than occurred during the 1960s. Outside the more urban counties, the other large communities include Hereford (15,853), Levelland (13,809), Dumas (12,194), Littlefield (7,409), Dalhart (6,854), Tulia (5,033), and Dimmitt (5,019). Population densities in the rural counties, generally higher than in New Mexico, range from 25.6 persons per sq mi in Hockley County to a low of 1.5 persons per sq mi in Oldham County.

Persons of Spanish origin constitute the largest ethnic or racial minority group in the region, ranging from more than 40 percent of the residents in Deaf Smith to

Table 3.3.3.4-1. Population and population change 1970 to 1980, by county, in the Texas/New Mexico impact region (Page 1 of 2).

State/County	Population			Population Change 1970-1980		
	1970 Census Count	1976 Estimated	1980 Census Count	Number	Percent Change	Annual Rate[1]
Texas	11,198,655	12,806,000	14,228,383	3,029,728	27.1	2.4
Bailey	8,487	7,900	8,168	-319	-3.8	-0.4
Castro	10,394	10,600	10,556	162	1.6	0.2
Cochran	5,326	4,800	4,825	-501	-9.4	-1.0
Dallam	6,012	6,700	6,531	519	8.6	0.8
Deaf Smith	18,999	20,200	21,165	2,166	11.4	1.1
Hale	34,137	35,300	37,592	3,455	10.1	1.0
Hartley	2,782	3,400	3,987	1,205	43.3	3.7
Hockley	20,396	21,100	23,230	2,834	13.9	1.3
Lamb	17,770	17,400	18,669	899	5.1	0.5
Lubbock	179,295	200,200	211,651	32,356	18.0	1.7
Moore	14,060	14,900	16,575	2,515	17.9	1.7
Oldham	2,258	2,600	2,283	25	1.1	0.1
Parmer	10,509	10,200	11,038	529	5.0	0.5
Potter	90,511	92,800	98,637	8,126	9.0	0.9
Randall	53,885	64,500	75,062	21,177	39.3	3.4
Sherman	3,657	3,80	3,174	-483	-13.2	-1.4
Swisher	10,373	10,100	9,723	-650	-6.3	-0.6
17-County Total	488,851	526,500	562,866	74,015	15.1	1.4

T5128/8-20-81

Table 3.3.3.4-1. Population and population change 1970 to 1980, by county, in the Texas/New Mexico impact region (Page 2 of 2).

State/County	Population			Population Change 1970-1980		
	1970 Census Count	1976 Estimated	1980 Census Count	Number	Percent Change	Annual Rate[1]
New Mexico	1,017,055	1,168,000	1,299,968	282,913	27.8	2.5
Chaves	43,335	49,000	5[illegible],103	7,768	17.9	1.7
Curry	39,517	42,700	42,019	2,502	6.3	0.6
DeBaca	2,547	2,500	2,454	-92	-3.7	-0.4
Harding	1,348	1,300	1,090	-258	-19.1	-2.1
Quay	10,903	11,200	10,577	-326	-3.0	-0.3
Roosevelt	16,479	16,500	15,695	-784	-4.8	-0.4
Union	4,925	4,900	4,725	-200	-4.1	-0.4
7-County Total	117,840	128,100	127,663	9,823	8.3	0.8
24-County ROI	606,691	654,600	690,529	83,838	13.8	1.3

T5128/8-12-81

[1] Annual compound rate of change.

Sources: U.S. Bureau of the Census, New Mexico Final Population and Housing Unit Counts, (PHC80-V-33); Texas Final Population and Housing Unit Counts, (PHC80-V-45), March 1981.

Table 3.3.3.4-2. Projected population and annual rates of population change by county in the Texas/New Mexico impact region, 1980-1994 (Page 1 of 2).

State/County	1980 Census Count	Projected Population				Projected Annual Rate of Change		
		1980	1985	1990	1994	1980-85	1985-90	1990-94
Texas								
Bailey	8,168	8,300	8,400	8,500	8,500	0.24	0.24	0.00
Castro	10,556	11,000	11,300	11,600	11,830	0.54	0.53	0.49
Cochran	4,825	5,200	5,200	5,200	5,350	0.00	0.00	0.71
Dallam	6,531	6,700	7,100	7,500	7,970	1.17	1.10	1.53
Deaf Smith	21,165	20,800	21,800	22,800	23,670	0.94	0.90	0.94
Hale	37,592	37,300	39,300	41,400	43,540	1.05	1.05	1.27
Hartley	2,987	3,500	3,900	4,300	4,610	2.10	1.97	1.76
Hockley	23,230	21,700	22,400	23,200	23,750	0.64	0.70	0.59
Lamb	18,669	17,700	17,600	17,600	17,510	-0.11	0.00	-0.13
Lubbock	211,651	214,100	229,800	243,200	254,410	1.43	1.14	1.13
Moore	16,575	14,500	14,800	15,200	15,590	0.41	0.53	0.64
Oldham	2,283	2,700	2,800	3,000	3,230	0.73	1.39	1.86
Parmer	11,038	10,300	10,300	10,400	10,710	0.00	0.19	0.74
Potter/Randall	173,699	162,600	172,800	183,100	192,080	1.22	1.16	1.20
Sherman	3,174	3,800	3,900	4,000	4,150	0.52	0.51	0.92
Swisher	9,723	10,500	10,700	11,100	11,570	0.38	0.74	1.04
17-County Total	562,866	550,700	582,060	612,030	638,470	1.11	1.01	1.06

T5129/9-16-81

Table 3.3.3.4-2. Projected population and annual rates of population change by county in the Texas/New Mexico impact region, 1980-1994 (Page 2 of 2).

State/County	1980 Census Count	Projected Population				Projected Annual[1] Rate of Change		
		1980	1985	1990	1994	1980-85	1985-90	1990-94
New Mexico								
Chaves	51,103	51,800	56,100	60,190	63,220	1.61	1.42	1.24
Curry	42,019	43,600	44,290	44,400	44,070	0.31	0.05	-0.19
DeBaca	2,454	2,600	2,600	2,500	2,500	0.00	-0.78	0.10
Harding	1,090	1,100	1,000	890	730	-1.89	-2.30	-4.83
Quay	10,577	11,200	11,290	11,200	11,030	0.16	-0.16	-0.38
Roosevelt	15,695	16,500	16,800	17,200	17,510	0.36	0.47	0.45
Union	4,725	4,900	4,800	4,900	4,900	-0.41	0.41	0.00
7-County Total	127,663	131,700	136,880	141,280	143,960	0.77	0.63	0.47
24-County Region	690,529	682,400	718,940	753,310	782,430	1.05	0.94	0.95

T5129/9-16-81

[1] 1980 projected population may not equal 1980 census count since some state demographic projection models have not yet incorporated 1980 census data.

Sources: U.S. Bureau of the Census, New Mexico Final Population and Housing Unit Counts, (PHC80-V-33); Texas Final Population and Housing Unit Counts, (PHC80-V-45), March 1981.

Texas Dept. of Water Resources, Population Projections for Texas: State, county, State Planning Region and 208 Water Quality Designated Areas, Jan. 22, 1980; Bureau of Business and Economic Research, University of New Mexico, Population Estimates and Projections; 1970-2000; Counties and Wastewater Facility Planning Areas, Sept. 1979.

as little as 4 percent in Randall County (see Table 3.2.3.4-3). Blacks and Native Americans comprise considerably smaller shares of the population, with a maximum of 7.5 percent blacks in Lubbock and 0.7 percent for Native Americans in Dallam County. The age distribution of residents has shown an upward trend since 1970, with the state's median age increasing to 28.2 years from 26.6 in 1970, and the proportion of school-age population (5-17) decreasing from 26.8 percent in 1970 to 22.2 percent in 1980. Average household sizes also decreased since 1970 but are higher than the national average in 13 of the 17 counties, ranging from a high of 3.34 persons per household in Castro County to a low of 2.58 in Potter.

During the next decade, the population of the 17-county area is projected to expand by 61,300 persons, reaching 612,000 by 1990, which represents an annual growth rate of 1.1 percent. About 88 percent of the growth is forecasted for the Lubbock, Amarillo, and Plainview areas, although Hartley County is projected to have the highest growth rate.

New Mexico

Population in the seven-county New Mexico portion of the ROI expanded very slowly, by 9,800 persons, during the past decade, reaching 127,700 in 1980. The five most rural counties experienced small population losses which were offset by population gains in Chaves and Curry counties. The annual growth rate of the seven-county area, 0.8 percent, was only one-third as high as that of the state as a whole. About three-fourths of the population resided in Chaves and Curry, which together experienced growth of about 10,000 persons, while population losses in the five rural counties totaled about 1,700. The region is sparsely settled outside the two most urban counties, with densities ranging from 6.4 persons per sq mi in Roosevelt to less than 1 person per sq mi in Harding. In addition to Roswell in Chaves County (39,676) and Clovis in Curry County (31,194), the larger communities include Portales in Roosevelt County (9,940) and Tucumcari in Quay County (6,765), both of which experienced population losses between 1970 and 1980.

As in Texas, the predominant ethnic minority group is of Spanish origin, with the proportion ranging from 44 percent in Harding County to 20 percent in Curry. Blacks and Native Americans constitute small shares of area residents, with the largest concentration of 6.8 percent for blacks in Curry and 0.9 percent for Native Americans in De Baca (see Table 3.3.3.4-3). In parallel with national trends, the age distribution of New Mexico residents increased since 1970, although it remains younger than the national average. The median age of New Mexicans increased to 27.4 years in 1980 from 23.8 in 1970, and the proportion of school-age population (5-17) decreased from 30.5 percent in 1970 to 23.2 percent in 1980. Average household size, which tends to be smaller in the seven-county area than in the state and the nation, decreased over the decade and ranged from 2.44 in De Baca to 2.82 persons per household in Curry.

The population of the New Mexico portion of the ROI is forecasted to remain almost stationary during the next decade, increasing by about 9,000 residents. The area's population is projected to reach 141,300 by 1990, representing an annual growth rate of 0.7 percent.

Table 3.3.3.4-3. Selected population characteristics, by county, Texas/New Mexico deployment area, 1980.

State/County	Density Persons/Sq Mi	Racial/Ethnic Groups as Percent of Total Population			Households	
		Black	American Indian	Spanish Origin	Number	Average Size
Texas	54.3	12.0	0.3	21.0	4,928,965	2.82
Bailey	9.8	2.2	0.1	33.9	2,681	3.02
Castro	12.0	3.2	0.3	38.6	3,136	3.34
Cochran	6.2	1.7	0.0	34.8	1,515	3.12
Dallam	4.4	2.5	0.7	16.7	2,386	2.74
Deaf Smith	14.0	1.9	0.2	40.7	6,487	3.24
Hale	38.4	5.4	0.2	33.7	12,385	2.97
Hartley	2.7	0.5	0.2	4.4	1,361	2.87
Hockley	25.6	4.0	0.3	27.0	7,522	3.01
Lamb	18.3	6.1	0.3	30.4	6,408	2.89
Lubbock	237.0	7.5	0.3	19.6	72,627	2.76
Moore	18.2	0.2	0.5	19.6	5,590	2.96
Oldham	1.5	0.6	0.6	5.1	674	2.80
Parmer	12.8	1.8	0.2	32.7	3,489	3.13
Potter	109.8	8.0	0.5	11.7	37,769	2.58
Randall	82.1	0.8	0.3	4.4	26,709	2.73
Sherman	3.5	0.1	0.0	11.5	1,117	2.81
Swisher	10.9	4.8	0.1	27.5	3,294	2.93
New Mexico	10.7	1.9	8.1	36.6	440,575	2.90
Chaves	8.4	2.2	0.6	30.6	18,194	2.73
Curry	29.9	6.8	0.4	19.5	14,419	2.82
DeBaca	1.0	0.0	0.9	31.0	989	2.44
Harding	0.5	0.0	0.1	44.3	412	2.65
Quay	3.7	1.3	0.4	35.5	3,936	2.67
Roosevelt	6.4	1.3	0.6	21.5	5,645	2.58
Union	1.2	0.0	0.3	31.2	1,724	2.70

T5268/8-26-81

Sources: U.S. Bureau of the Census, New Mexico Final Population and Housing Unit Counts, (PHC80-V-33); Texas Final Population and Housing Unit Counts, (PHC80-V-45), March 1981; and Population and Households by States and Counties, (PC80-51-2), May 1981.

Housing (3.3.3.4.2)

Texas/New Mexico

By 1994, projected baseline housing unit requirements will total 295,000 in the 24 county, two state region of influence. Growth from a 1982 projected baseline of 263,000 units will average 1.0 percent per year. Of the 1994 total, 81 percent (240,000 units) are expected in Texas with a large concentration in Lubbock County (40 percent, 96,000 units) and in the counties of Potter and Randall (32 percent, 76,000). Of the 55,000 units in New Mexico in 1994, the majority will be located in Chaves County (44 percent, 24,000 units) and Curry County (30 percent, 16,000 units). Projected baseline housing unit figures at the county and deployment region levels are presented in Table 3.3.3.4.2-1. More detailed baseline information for those counties expected to experience long-term effects is presented in Chapter 3. Counties experiencing only short-term impacts are dealt with in Chapter 4 only.

Transportation (3.3.3.5)

Roads (3.3.3.5.1)

The principal routes are U.S. 82 and 180 (east-west) and U.S. 87, 285, and 385 and Interstate 22 (north-south). Figure 3.3.3.5-1 shows the principal federal and state highways and annual average daily traffic. In addition, numerous county roads cross the area, connecting the cities and communities.

There are few topographic features that influence alignment or grades. Most of the roadways are two-lane facilities, but the interstate route and some of the federal and state routes are four lanes. The roads are generally of good quality, with few capacity restrictions, and carry current traffic at a high level of service. However, most of the roads were designed for low volumes and, as described in comments by the Eastern Plains Council of Governments, "are relatively substandard for heavy vehicle traffic."

Load-carrying limits for reducible loads in New Mexico are the same for the interstates, U.S. highways, and state routes. For loads which cannot be reduced or dismantled, the limits are 24,000 lb for a single-axle truck, and 44,000 lb for a tandem. Weights for multiple-axle vehicles are based on vehicle size and axle spacing. Width, height, and length legal limits are 8 ft, 13 ft 6 in., and 65 ft, respectively.

In Texas, the load-carrying limits are 20,000 lb for a single axle and 34,800 lb for tandem axles. The maximum width is 8 ft. With a permit, axle loads up to 25,000 lb and widths up to 20 ft are permitted.

Railroads (3.3.3.5.2)

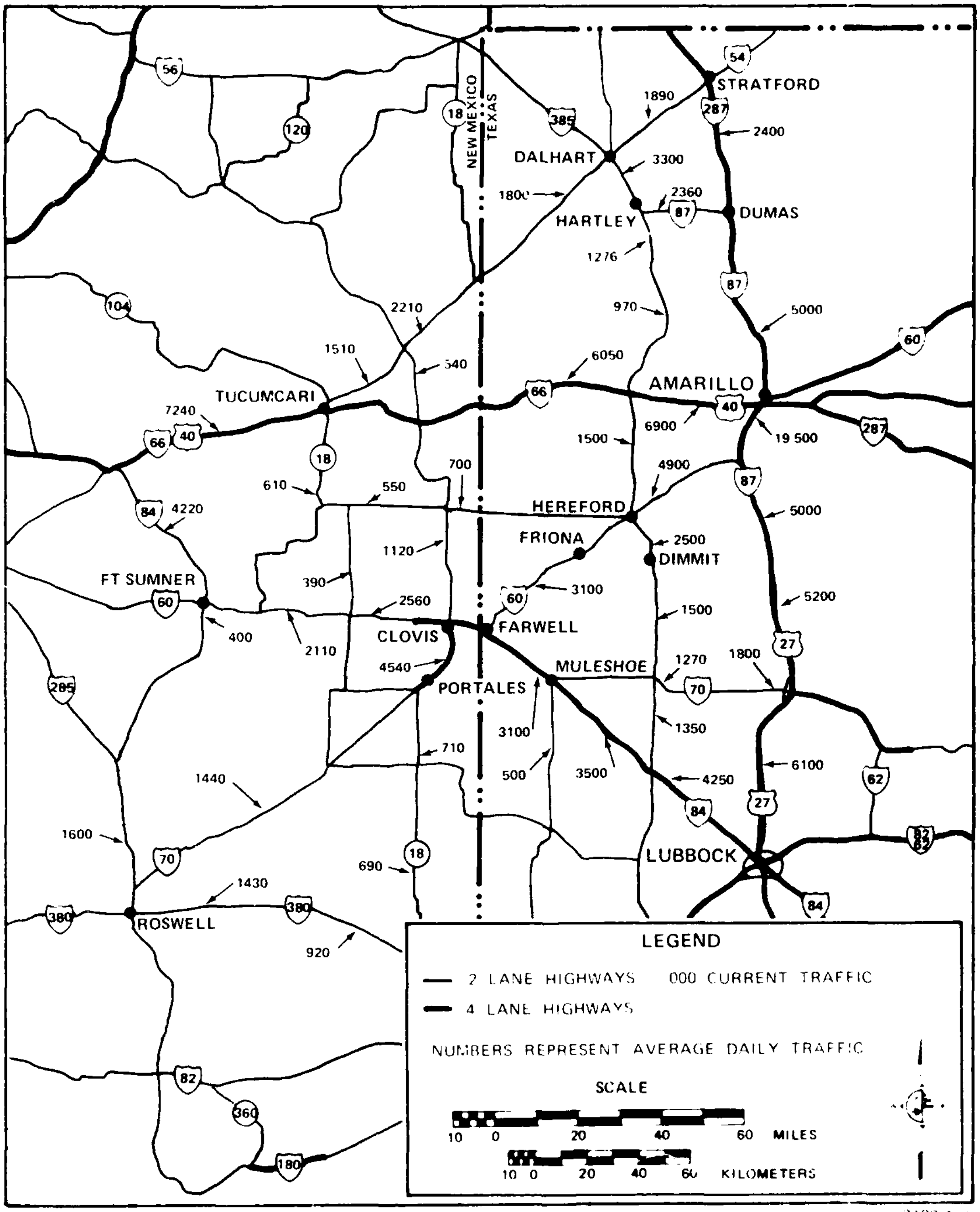
The Southern Pacific Transportation Company Line serves the cities of Tucumcari, New Mexico, and Dalhart, Texas, among other cities. The Atchison, Topeka, and Santa Fe Railroad services Vaughn, Clovis, Amarillo, and other cities. The Colorado and Southern Railroad runs southeasterly through the northeast tip of New Mexico and into Texas to Dalhart and Amarillo.

Table 3.3.3.4.2-1. Projected baseline housing units by county (trend)

State/County	Ave. Annual % Change 1982-1994	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Texas														
Bailey	0.2	2,896	2,903	2,910	2,921	2,924	2,931	2,938	2,945	2,952	2,955	2,955	2,955	2,955
Castro	0.5	3,493	3,512	3,530	3,552	3,568	3,587	3,606	3,625	3,647	3,662	3,681	3,700	3,719
Cochran	0.2	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,760	1,774	1,787	1,800
Dallam	1.3	2,625	2,625	2,686	2,721	2,748	2,778	2,809	2,840	2,874	2,916	2,962	3,008	3,054
Deaf Smith	0.9	6,867	6,932	6,997	7,065	7,126	7,191	7,256	7,321	7,386	7,457	7,528	7,600	7,671
Hale	1.1	13,463	13,604	13,749	13,894	14,039	14,184	14,332	14,484	14,633	14,820	15,008	15,198	15,393
Hartley	2.0	1,335	1,365	1,394	1,423	1,451	1,482	1,511	1,540	1,540	1,570	1,599	1,628	1,657
Hockley	0.7	7,664	7,713	7,762	7,814	7,866	7,922	7,978	8,034	8,093	8,138	8,187	8,236	8,285
Lamb	-0.1	6,413	6,405	6,398	6,394	6,394	6,394	6,394	6,394	6,394	6,384	6,376	6,369	6,362
Lubbock	1.2	83,787	84,982	86,195	87,420	88,417	89,425	90,445	91,476	92,518	93,568	94,629	95,702	96,789
Moore	0.5	5,183	5,204	5,225	5,250	5,275	5,303	5,332	5,360	5,388	5,424	5,459	5,495	5,530
Oldham	1.4	1,024	1,031	1,039	1,046	1,061	1,076	1,091	1,106	1,125	1,144	1,166	1,189	1,211
Parmer	0.3	3,455	3,455	3,455	3,455	3,459	3,465	3,472	3,479	3,489	3,512	3,539	3,566	3,593
Potter/Randall	1.2	66,261	67,073	67,896	68,727	69,527	70,334	71,153	71,985	72,824	73,699	74,586	75,485	76,395
Sherman	0.7	1,431	1,439	1,446	1,454	1,461	1,469	1,476	1,483	1,495	1,506	1,521	1,536	1,551
Swisher	0.8	3,788	3,802	3,817	3,834	3,860	3,888	3,917	3,946	3,974	4,017	4,060	4,103	4,146
New Mexico														
Chaves	1.4	20,565	20,896	21,235	21,577	21,881	22,192	22,508	22,827	23,150	23,438	23,727	24,019	24,315
Curry	0.0	16,335	16,387	16,439	16,491	16,498	16,506	16,513	16,521	16,532	16,498	16,469	16,439	16,409
DeBaca	-0.3	1,119	1,119	1,119	1,119	1,106	1,097	1,089	1,080	1,076	1,076	1,076	1,076	1,076
Harding	-3.0	416	408	400	396	384	376	368	361	353	337	321	305	289
Quay	-0.1	4,416	4,424	4,432	4,440	4,432	4,424	4,416	4,408	4,404	4,385	4,369	4,353	4,338
Roosevelt	-.4	6,760	6,784	6,809	6,837	6,866	6,898	6,931	6,963	7,000	7,028	7,061	7,094	7,126
Union	0.1	1,886	1,878	1,871	1,867	1,871	1,878	1,886	1,894	1,906	1,906	1,906	1,906	1,906
Texas/New Mexico deployment region	1.0	262,932	265,721	268,553	271,448	273,965	276,553	279,172	281,821	284,531	287,230	289,989	292,778	295,598

T5334/9-16-81

Sources: HDR Sciences, based on data from the Texas Department of Water Resources, Population Projections for Texas: State, County, State Planning Region and 208 Water Quality Designated Areas, January 22, 1980; Bureau of Business and Economic Research, University of New Mexico, Population Estimates and Projections; 1970-2000; Counties and Wastewater Facility Planning Areas, September 1979.



SOURCE: TEXAS STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION, 1978. NEW MEXICO STATE HIGHWAY DEPARTMENT, 1980

Figure 3.3.3.5-1. Existing roads and communities in the Texas/New Mexico study area.

Air Traffic (3.3.3.5.3)

Airline service is provided by the commercial airports at Clovis and Roswell, New Mexico, and Lubbock, and Amarillo, Texas.

Energy (3.3.3.6)

Electric Power Supply

The Texas/New Mexico study area is serviced by Region 22 of the Southwest Power Pool (SWPP). Projected peak demands without M-X and actual reserve margins are presented for summer conditions in Table 3.3.3.6-1. At present the majority of electric power is produced by burning natural gas. Much of the projected increase in capacity will be generated with coal-fired facilities.

A map of the existing and proposed transmission lines is shown in Figure 3.3.3.6-1.

Fuel Supply

Within the Texas/New Mexico region, there are numerous natural gas, crude oil, and product oil pipelines. A map of the existing and proposed pipelines produced from information supplied by the energy companies and the federal agencies is presented in Figure 3.3.3.6-2. Projected fuel consumptions for the area are presented in Table 3.3.3.6-2.

Land Ownership (3.3.3.7)

Federal Land, Texas/New Mexico

The location of federal land is shown in Figure 3.3.3.7-1. The amount of federal and BLM-administered land is presented in Table 3.3.3.7-1. The major National Park Service holding is the Lake Meredith National Recreational Area. The Kiowa and Rita Blanca National Grasslands in eastern Union and northern Dallam counties are administered by the U.S. Forest Service. The Buffalo Lake National Wildlife Reserve in Randall County is another large federal land parcel managed by the U.S. Fish and Wildlife Service.

Private Land, Texas/New Mexico

Most of the land in the study area is privately owned. Chaves County is the only New Mexico county with less than 50 percent in private ownership. Most of BLM-administered land is located in the western part of the county. The New Mexico counties are about 80 percent privately owned. Texas counties are almost entirely privately owned. Figure 3.3.3.7-2 shows the location of private land and Table 3.3.3.7-1 the number of acres of private land and its percentage of total land in each county.

State Trust Land, Texas/New Mexico

About 10,700 acres of state trust land are located in the Texas/New Mexico deployment area counties. Most of these lands are school trust lands which were sold

Table 3.3.3.6-1. Oklahoma Group (Region 22) peak demand reserve margin (Texas/New Mexico).

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Region 22									
Actual Reserves (MW)[1]									
Summer[3]	4,486	4,143	3,972	5,380	5,257	4,723	4,573	4,163	3,738
Peak Demand (MW)[1]									
Summer[4]	14,687	15,621	15,845	16,416	17,004	17,615	18,261	18,889	19,500
Actual Reserves (percent)[2]									
Summer	30.5	27.1	25.1	32.8	30.9	26.8	25.0	22.0	19.2

T4996/9-19-81

[1] DOE/ERA-411 "Regional Reliability Council Coordianted Bulk Power Supply Program," Southwest Power Pool (April 1, 1981).

[2] $\frac{\text{Actual Reserves}}{\text{Peak Demand}} \times 100\%$

[3] Reserves are lowest in summer.

[4] Demand is highest in summer.

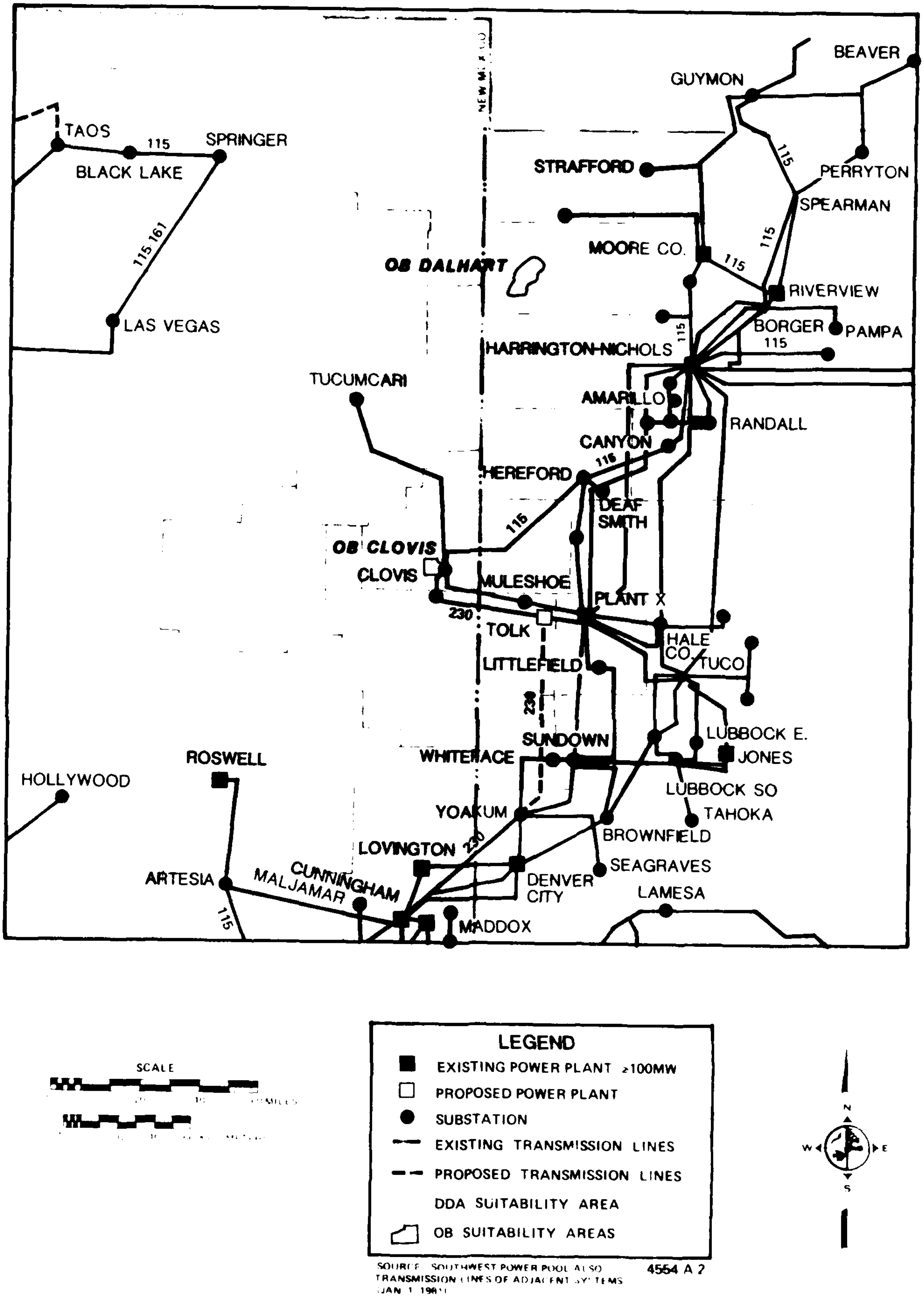
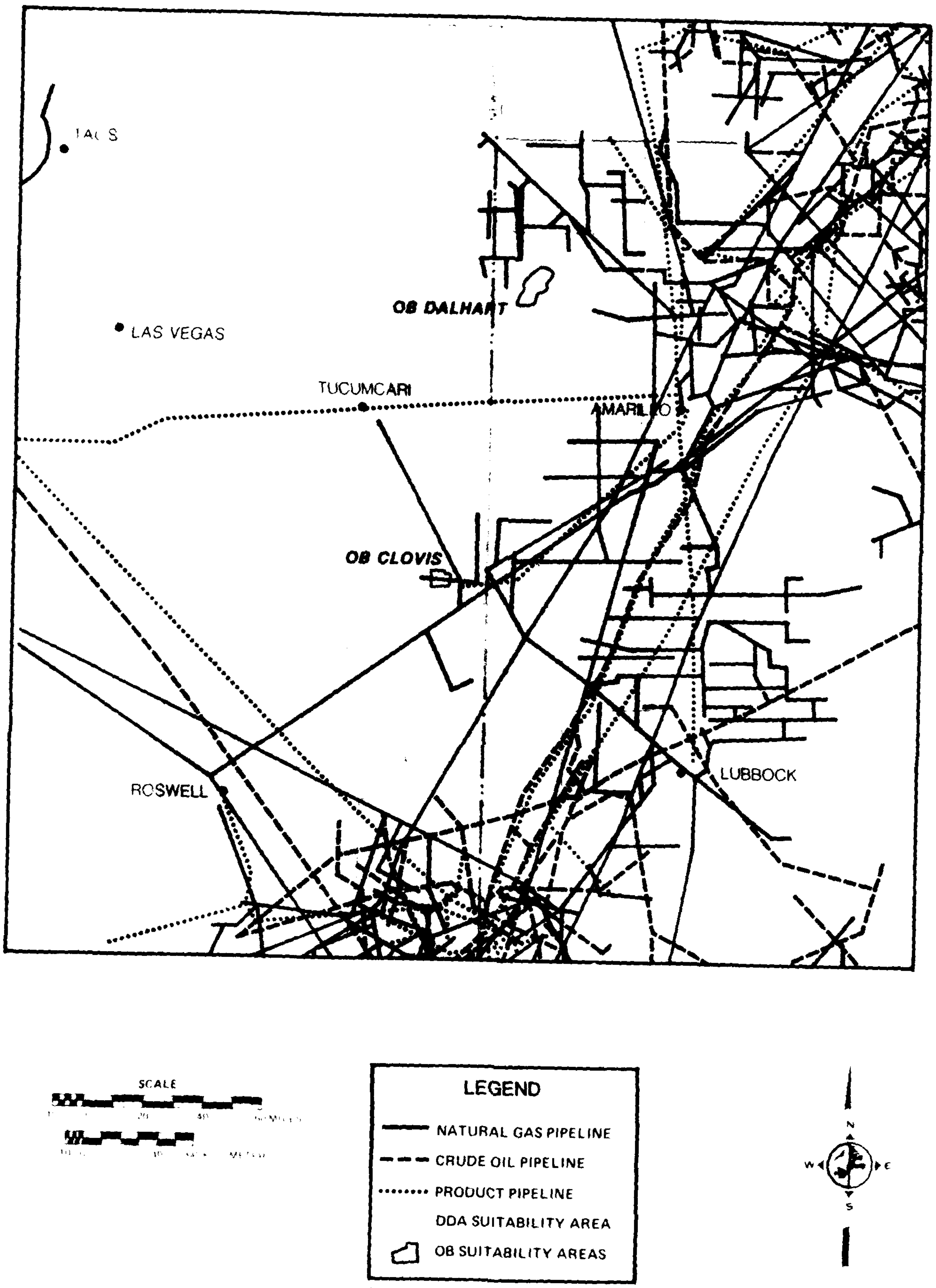


Figure 3.3.3.6-1. Existing and proposed transmission lines in Texas/New Mexico study area.



SOURCE OIL AND GAS JOURNAL 4665 A

Figure 3.3.3.6-2. Existing and proposed natural gas pipelines in the Texas/New Mexico study area.

Table 3.3.3.6-2. Fuel consumption projections.

Fuel	Texas			New Mexico		
	1978	1985	1990	1978	1985	1990
Total Petroleum (10^3 BBLS)	448,520	398,150	403,030	42,910	34,970	35,400
Natural Gas (Dry) (10^6 ft^3)	4,211,430	4,000,860	4,169,320	213,700	203,010	211,560
Total Fuel Oil (Dist.) (10^3 BBLS)	8,170	65,420	69,900	9,630	7,760	8,290
Diesel Fuel (Dist.) (10^3 BBLS)	25,230	20,330	21,730	3,570	2,880	3,070
Heating Fuel (Dist.) (10^3 BBLS)	10,080	8,120	8,680	520	420	450
Gasoline (10^3 BBLS)	201,990	169,270	160,990	18,920	18,920	15,080
Jet Fuel (10^3 BBLS)	28,540	28,540	31,130	2,790	2,790	3,050

T3310

1 Barrel = 42 Gallons

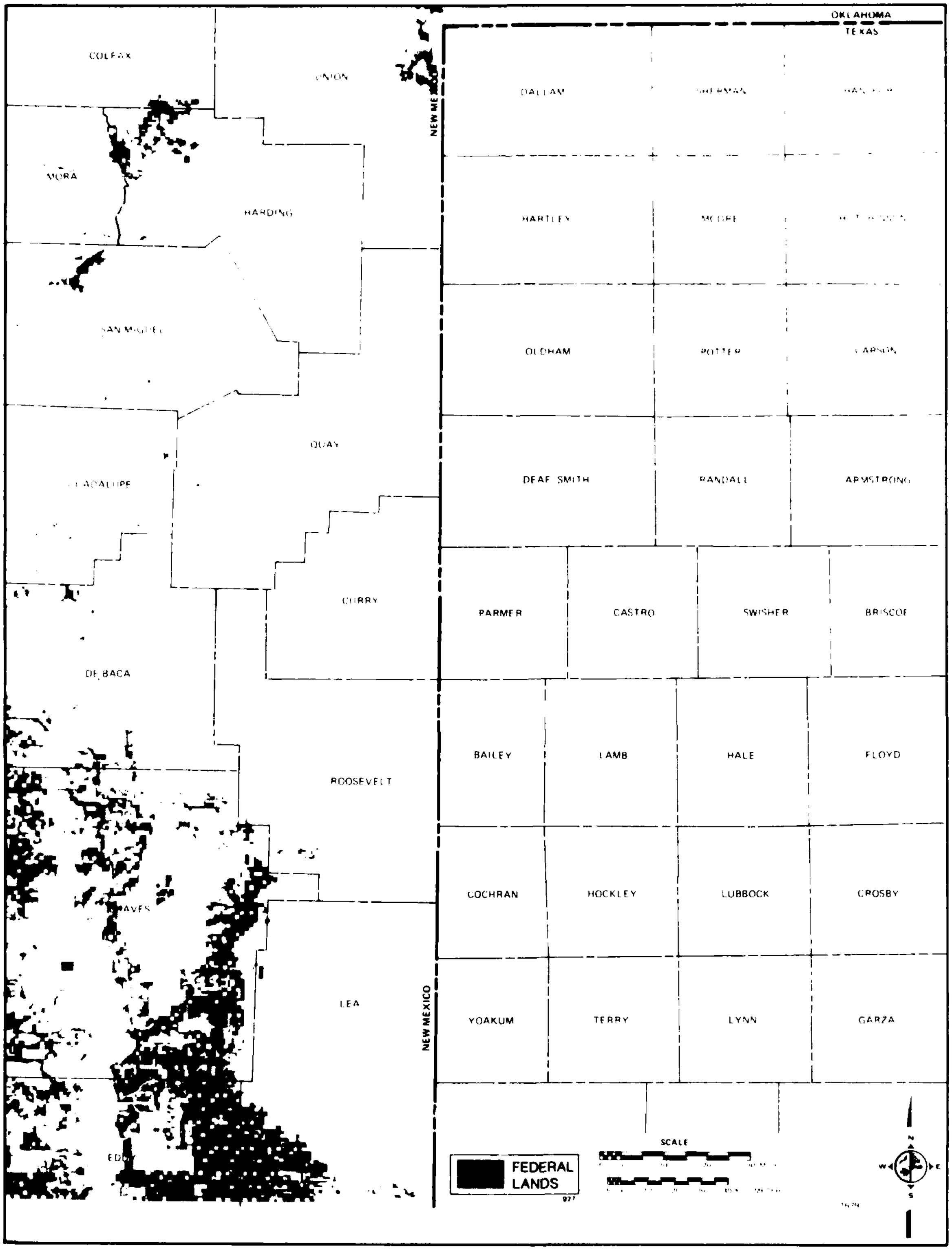
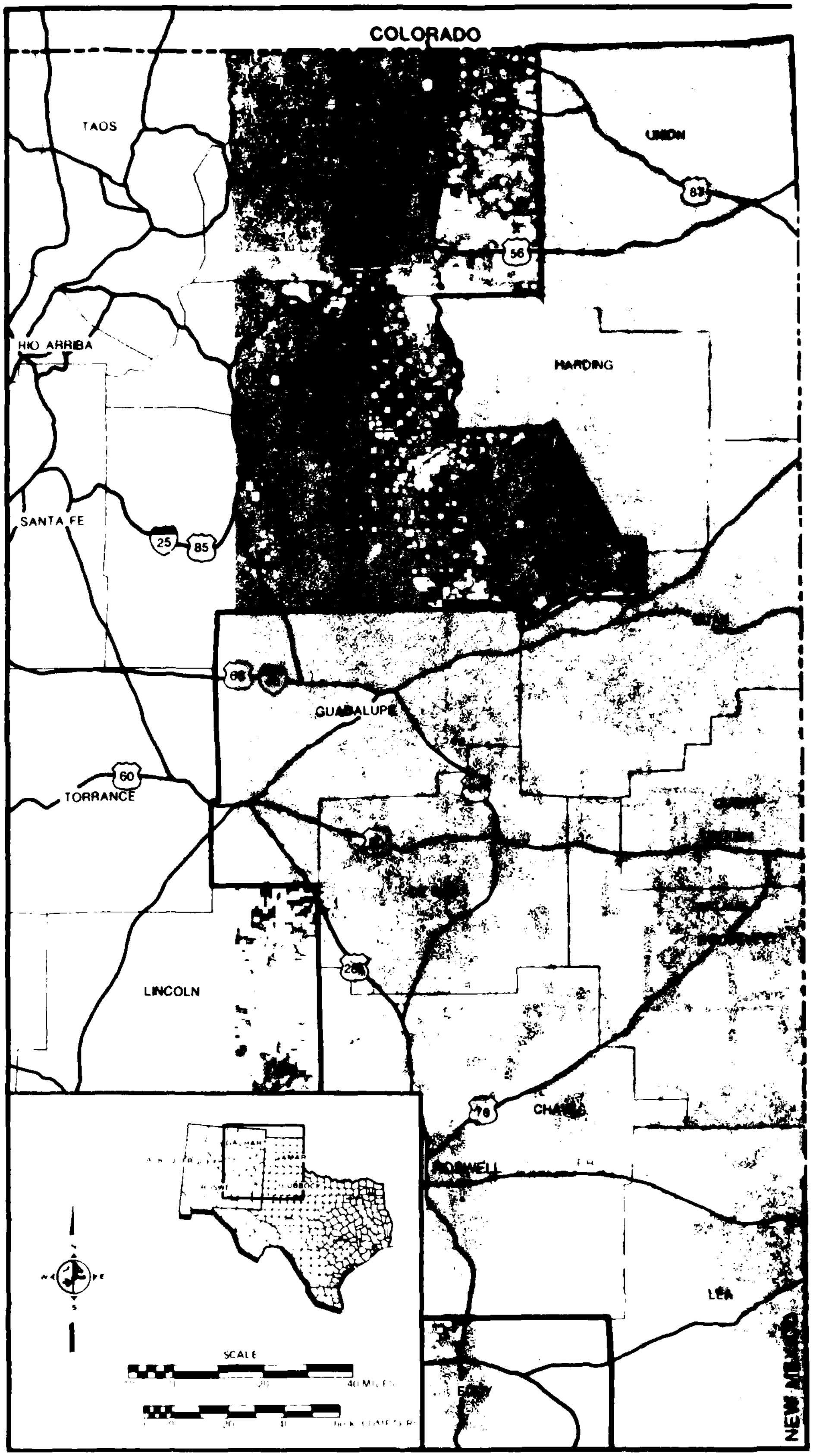


Figure 3.3.3.7-1. Federal lands in the Texas/New Mexico study area.


COLORADO
TAOS
UNION
83
56
HARDING
RIO ARRIBA
SANTA FE
25
85
66
GUADALUPE
60
TORRANCE
285
LINCOLN
70
CHAVES
ROSWELL
LEA
EDDY
NEW MEXICO
SCALE
40 MILES

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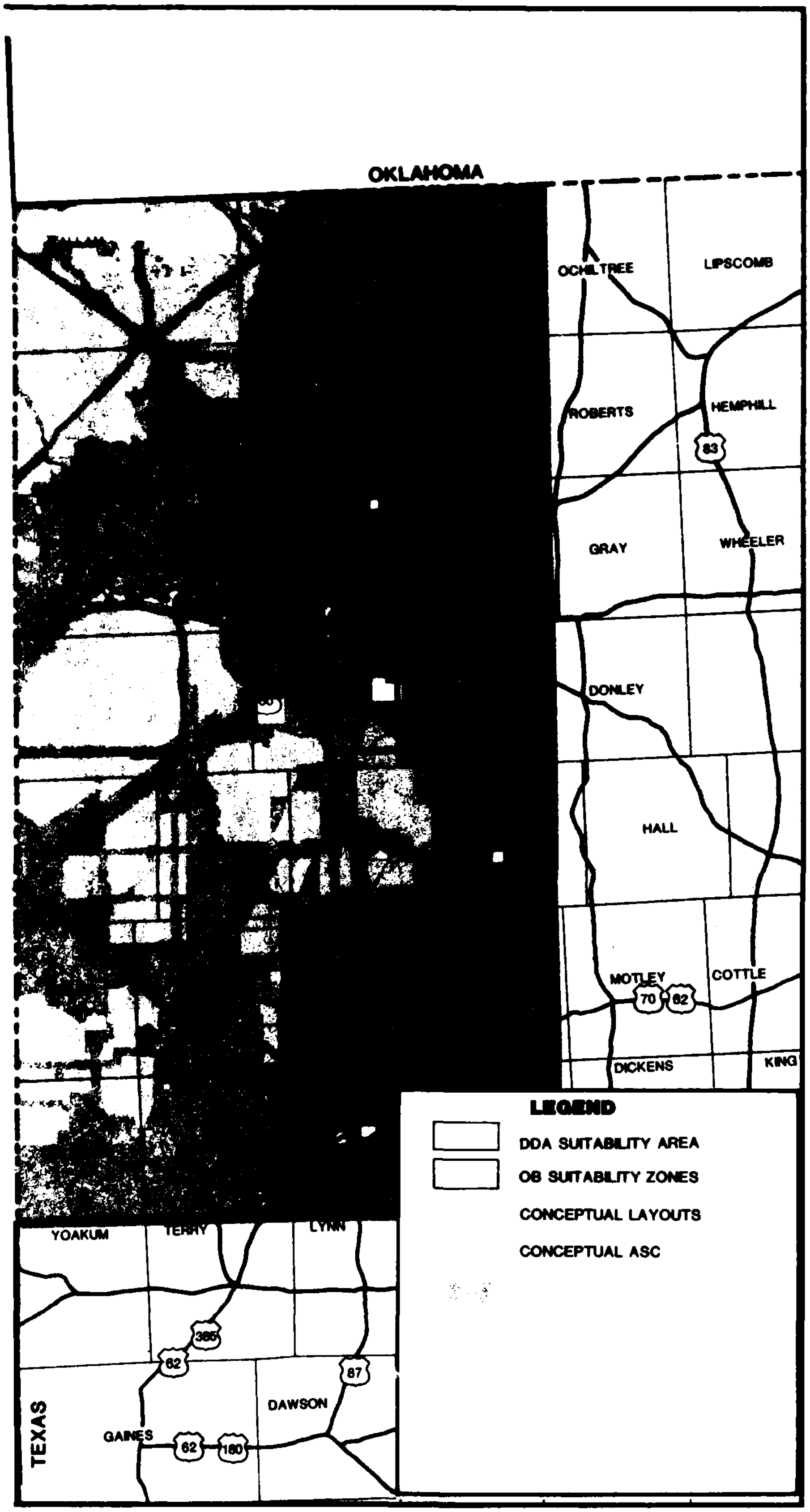

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Figure 3.3.3.7-2. Private land in the Texas/New Mexico study area.

Table 3.3.3.7-1. BLM-administered, state and private lands in the Texas/New Mexico study area counties, in thousands of acres (Page 1 of 2).

State/ County	Total Area	Federal Lands	Percent of Total	BLM-Administered Land	Percent of Total	State Lands	Percent of Total	Privately Owned Lands	Percent of Total
Texas									
Bailey	536	5.8	1.1	--	--	--	--	530	98.9
Castro	563	--	--	--	--	--	--	563	100.0
Cochran	501	--	--	--	--	0.4	0.1	501	100.0
Dallam	956	77.2	8.1	--	8.1	9.0	0.1	879	91.9
Deaf Smith	736	--	--	--	--	--	--	736	100.0
Hale	626	--	--	--	--	--	--	626	100.0
Hartley	956	--	--	--	--	--	--	956	100.0
Lamb	654	--	--	--	--	0.2	--	654	100.0
Moore	582	--	--	--	--	--	--	575	98.8
Oldham	946	--	--	--	--	0.1	--	946	100.0
Parmer	550	--	--	--	--	0.6	--	550	100.0
Randall	585	7.2	1.4	--	--	--	--	567	96.9
Swisher	573	0.6	0.1	--	--	0.4	0.1	572	99.8

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Table 3.3.3.7-1. State, private and BLM-administered lands in the Texas/New Mexico study area counties, in thousands of acres (Page 2 of 2).

State/ County	Total Area	Federal Lands	Percent of Total	BLM-Administered Land	Percent of Total	State Lands	Percent of Total	Privately Owned Lands	Percent of Total
New Mexico									
Chaves	3,901	1,239.6	31.8	1,219.5	31.3	768.9	19.7	1,932	49.5
Curry	899	3.9	8.4	0.4	0.4	60.7	6.8	834	92.8
De Baca	1,514	90.8	6.0	81.5	5.4	243.6	16.1	1,180	77.9
Harding	1,368	70.5	5.2	7.7	0.6	345.0	25.2	953	96.7
Lea	2,812	427.6	15.2	429.6	15.2	934.4	33.2	1,471	52.3
Quay	1,845	14.5	0.8	7.6	0.4	237.7	12.9	1,593	86.3
Roosevelt	1,572	38.5	2.4	16.4	1.0	211.1	13.4	1,323	84.2
Union	2,443	58.7	2.4	0.5	0.02	441.9	18.1	1,942	79.5
Study Area Totals	22,306	2,039.9	7.7	1,761.2	5.8	3,250.0	12.3	18,412	80.1

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Note: Percent totals may not equal 100% due to rounding. Dash indicates less than 50 acres or less than 0.05 percent.

Sources: Texas State Land Office, March 19, 1981, and Southwestern New Mexico Economic Development District, June 1979.

to private interests but title has since revested to the state because of nonpayment. The scattered, small parcels; and their locations are not readily available (Texas General Land Office, March 19, 1981). They would be specifically identified, however, during analysis for subsequent tiered decision making if they become part of the proposed M-X system. In New Mexico, lands were conveyed to the state by the federal government as a condition of statehood. Figure 3.3.3.7-3 shows that at least two sections in every township are owned by the state. Table 3.3.3.7-1 shows the amount and percentage of state land by county.

Native American Land, Texas/New Mexico

There are no Native American lands within the geotechnically suitable areas.

Land Use (3.3.3.8)

Agricultural land in the Texas/New Mexico region is used for crops and grazing. Many of the cropland areas have irrigation systems that have increased the productivity of these lands. Table 3.3.3.8-1 indicates the number of farms, total farmland acreage, and the percentage of total farmland in relation to both the county and the state. Farming trends from 1950-1974 are shown in Table 3.3.3.8-2. Since 1950, harvested areas in New Mexico have fallen 50 percent, and in Texas 30 percent, due to water, labor and energy costs.

Cropland productivity is high in the High Plains region of Texas. This high productivity zone, attributed to the Ogallala aquifer, extends west into portions of eastern New Mexico. (Further information on groundwater resources is found in Section 3.3.2.1.) Approximately 28 percent of the area is irrigated cropland. About 50 percent is rangeland and the remainder nonirrigated farmland.

Table 3.3.3.8-3 shows the amount of cropland, harvested cropland, and pasture land for the study area counties. As noted in the table, the New Mexico study area counties have a significantly higher proportion (61.2 percent) of the state's total cropland than the counties in Texas (13.4 percent). Table 3.3.3.8-4 provides data on the value of the agricultural products sold in the study area counties. Figures 3.3.3.8-1 and 3.3.3.8-2 show the location of irrigated and dry croplands in the Texas/New Mexico region.

Grazing

Approximately 50 percent of the proposed siting area in Texas and New Mexico is rangeland (Figure 3.3.3.8-3). Overall, approximately 86 percent of New Mexico and 73 percent of Texas are used for grazing and pasture land. This grazing is entirely on private rangeland, except in Chaves County, New Mexico, where the BLM administers some of the grazing lands (Council for Agricultural Science and Technology, 1974). As shown in Table 3.3.3.8-5, cattle and sheep inventories decreased in the New Mexico counties in the periods shown. Only the cattle inventory decreased in the Texas counties.

Cattle feedlots are an important regional industry. Cattle are shipped from as far away as New Hampshire. In New Mexico, nearly 60,000 cattle are fed annually in feedlots. This is about 10 percent of all cattle in the region. The industry is even larger in West Texas. About 75 percent of the 1.47 million cattle in the Texas study

area counties are maintained in feedlots. Approximately two-thirds of the cost and one-third of the weight of the beef are added in the feedlots. Most of the weight is fat, and it takes about nine pounds of irrigated corn to put a pound of fat on a calf or steer. About 2 million acre-ft of water are consumed annually, primarily for irrigated crops, the most demanding of which is corn. Water-intensive agriculture is expected to decrease about 7 percent by the year 2000 in response to reductions in the Ogallala aquifer. As overdrafts of the Ogallala aquifer continue, corn production will decrease. Since over 95 percent of the corn is used in regional feedlots, the feedlots may go out of business. Cattle will have to be shipped out of the region for fattening.

Ranch and Farm Houses

Many more ranch and farm houses are located in the more densely populated Texas/New Mexico region than in the Nevada/Utah region. Table 3.3.3.8-5a sets forth the number of dwelling units in each Texas/New Mexico county and the number of those units which lie in rural (non-urban) areas. These numbers were developed by taking the total dwelling units (DUs) per county from the 1980 Census of Population and Housing (preliminary reports) and subtracting the number of housing units in the cities, towns, and villages in each county from the total units in each county. The remainder is the number of ranch and farm houses.

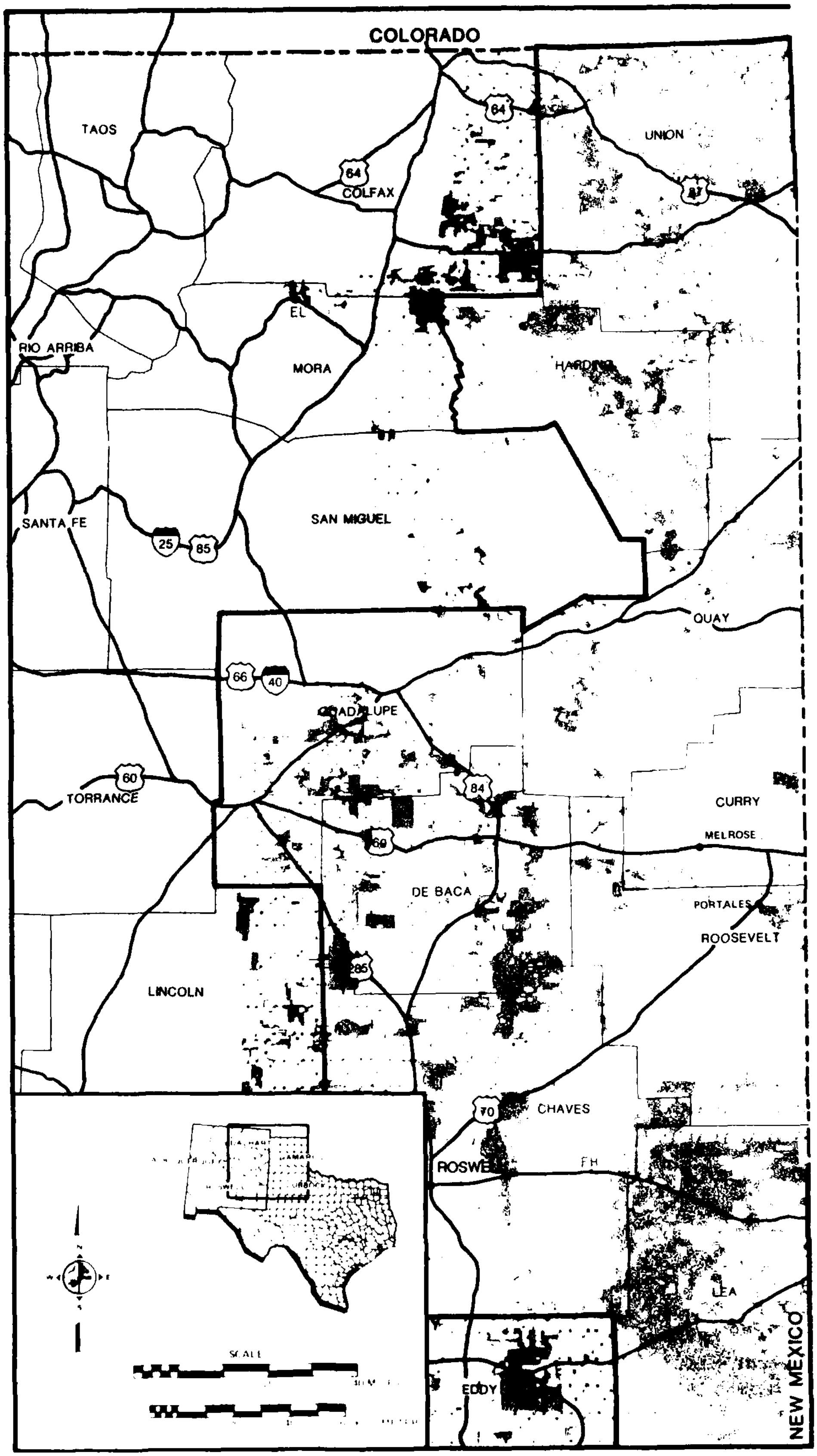
Prime Farmland

Paragraph 101(b)(4) of National Environmental Policy Act (NEPA) establishes a Federal policy to preserve important historic, cultural, and natural aspects of our national heritage, and to maintain, wherever possible, a diverse and varied environment, *including unique and prime* farmlands (Council on Environmental Quality, August 30, 1976).

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. It must also be available for these uses. The land could be cropland, pastureland, rangeland, forestland, or other cropland, but not urban built-up land or water. It has the soil quality, growing season, and moisture supply to economically produce sustained, high yields of crops when treated and managed (including water management) according to acceptable farming methods. Potential prime farmland is capable of becoming prime farmland with the addition of adequate drainage or irrigation. Additional requisites of prime farmland can be found in Section 3.1.2.3 of ETR-20 (Land Use). Figure 3.3.3.8-4 shows the location of prime farmland as presently established in the Texas/New Mexico region.

Texas

Prime farmland and potential prime farmland acreages for each Texas study area county are shown in Table 3.3.3.8-6. In the Texas siting region, existing prime farmland, as a percentage of the county's total land area, ranges from a low of 1.2 percent in Cochran County to a high of 81.9 percent in Swisher County. Five counties show a potential for additional prime farmlands while there is no potential prime farmland in eight of the counties.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SANTA FE
SAN MIGUEL
QUAY
GUADALUPE
TORRANCE
CURRY
MELROSE
DE BACA
PORTALES
ROOSEVELT
LINCOLN
CHAVES
ROSWELL
LEA
EDDY
NEW MEXICO
SCALE

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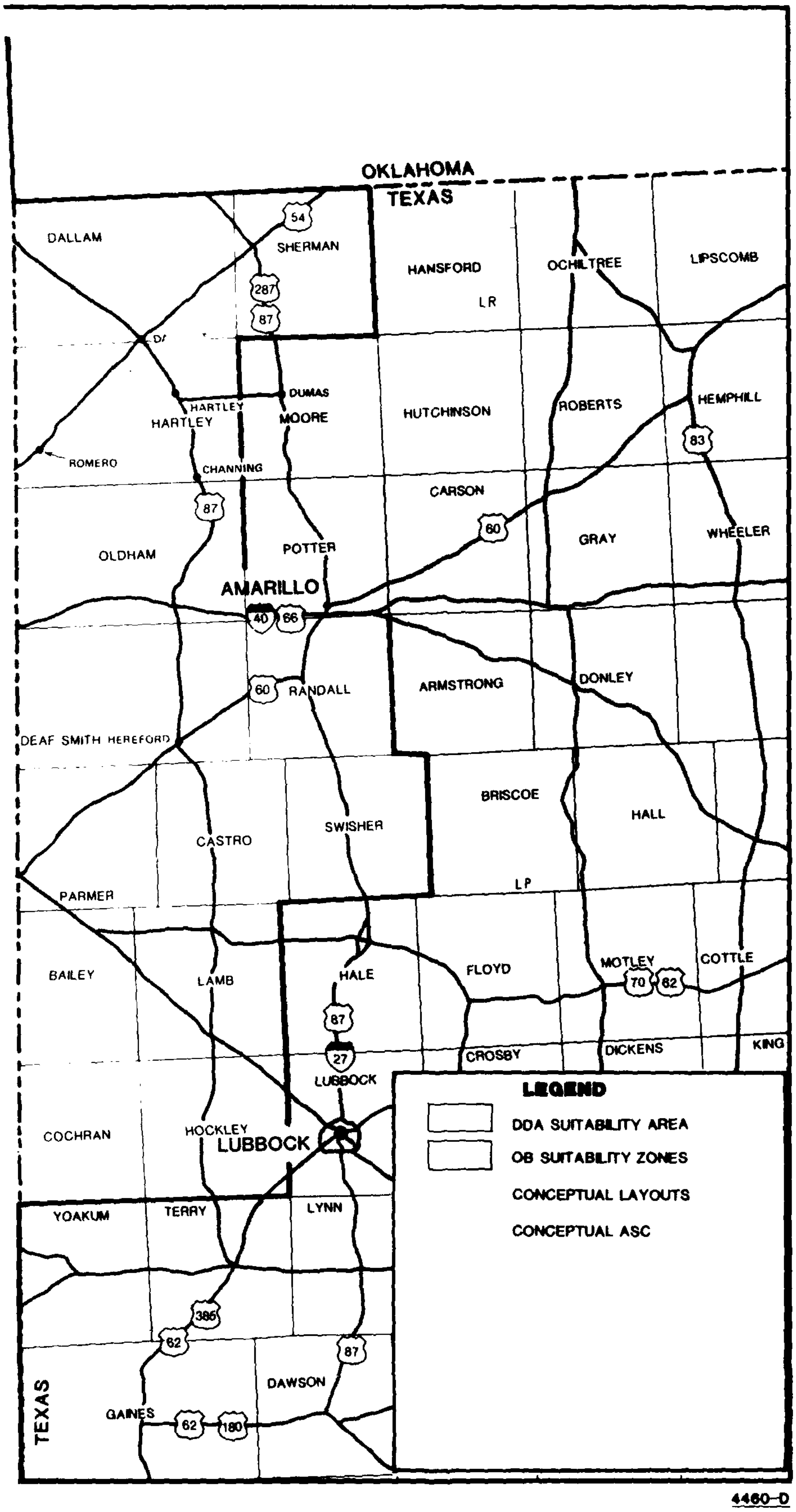

Figure 3.3.3.7-3. State trust lands in the Texas/New Mexico study area.

Table 3.3.3.8-1. Farmland in Texas and New Mexico study area counties, 1974 (Page 1 of 2).

County	Number of Farms	Average Farm Size Acres	Total Acreage in Farmland[1]	Farmland as Proportion of County Land (Percentage)[2]	County Farmland as Proportion of State Farmland (Percentage)
Texas					
Bailey	479	878	420,800	78.7	0.3
Castro	616	944	581,500	103.2	0.4
Cochran	297	1,376	408,600	81.6	0.3
Dallam	345	2,783	960,100	100.4	0.7
Deaf Smith	637	1,344	856,100	88.6	0.6
Hale	1,078	636	685,400	109.4	0.5
Hartley	196	4,657	912,800	95.9	0.7
Lamb	944	677	639,500	97.8	0.5
Moore	270	1,906	514,600	88.5	0.4
Oldham	154	5,296	815,600	86.3	0.6
Parmer	704	824	580,100	105.5	0.4
Randall	486	1,089	529,200	90.5	0.4
Sherman	300	1,865	559,500	95.4	0.4
Swisher	699	800	559,200	97.5	0.4
Total or average	7,205	1,252	9,023,000	90.1	6.7

T3212/9-13-81/F

Table 3.3.3.8-1. Farmland in Texas and New Mexico study area counties, 1974 (Page 2 of 2).

County	Number of Farms	Average Farm Size Acres	Total Acreage in Farmland[1]	Farmland as Proportion of County Land (Percentage)[2]	County Farmland as Proportion of State Farmland (Percentage)
New Mexico					
Chaves	517	5,316	2,771,600	71.2	5.9
Curry	636	1,316	837,200	93.3	1.8
DeBaca	177	7,198	1,274,000	84.5	2.7
Harding	175	7,874	1,377,900	100.9	2.9
Lea	512	4,404	2,254,900	80.2	4.8
Quay	607	3,226	1,957,900	106.4	4.2
Roosevelt	905	1,691	1,530,200	97.4	3.2
Union	416	4,916	2,045,000	83.7	4.3
Total or average	3,945	3,561	14,048,700	85.9	29.9
Texas/New Mexico Total	11,150	2,069	23,071,700	87.8	12.7

T3212/9-13-81/F

[1]Includes all cropland, pastures, and grazing land except that on open ranges under government permit.

[2]Tabulated as being in the operator's principal county which is defined as the one with the largest value of agricultural products produced. This is where the operator reported all of the largest portion of his total land. As a result of this procedure, several counties exceed 100 percent.

Source: U. S. Department of Commerce, 1977a.

Table 3.3.3.8-2. Trends in farming in Texas/ New Mexico, 1950-1978.

Year	Number of Farms	Acreage in Farms	Irrigated Acreage in Farms	Harvested Acreage in Farms
Texas				
1950	331,567	145,389,000	3,132,000	28,108,000
1954	292,947	145,813,000	4,707,000	24,885,000
1959	227,071	143,218,000	5,656,000	22,236,000
1964	205,115	141,705,000	6,385,000	19,408,000
1969	213,550	142,567,000	6,888,000	19,825,000
1974	174,068	134,185,000	6,594,000	19,014,000
1978	194,461	137,886,000	7,018,000	20,813,000
New Mexico				
1950	23,599	47,522,000	655,000	1,898,000
1954	21,070	49,451,000	650,000	1,135,000
1959	15,919	46,293,000	732,000	1,077,000
1964	14,206	47,646,000	813,000	906,000
1969	11,641	46,792,000	823,000	1,008,000
1974	11,282	47,046,000	867,000	976,000
1978	14,288	48,466,000	906,000	1,220,000

T3030/8-21-81

Source: U.S. Department of Commerce, 1977a; 1981.

Table 3.3.3.8-3. Cropland acreage in Texas/New Mexico study area counties, 1974 (Page 1 of 2).

County	Total Cropland	Harvested Cropland	Cropland Used Only For Pasture	Land Irrigated	Cropland as Proportion of State Cropland Percentage
Texas					
Bailey	299,000	137,000	20,000	119,000	0.8
Castro	441,000	330,000	25,000	295,000	1.2
Cochran	254,000	138,000	6,000	89,000	0.7
Dallam	324,000	212,000	31,000	111,000	0.8
Deaf Smith	510,000	285,000	31,000	238,000	1.4
Hale	574,000	468,000	34,000	401,000	1.6
Hartley	217,000	130,000	12,000	84,000	0.6
Lamb	451,000	327,000	18,000	277,000	1.2
Moore	228,000	154,000	11,000	121,000	0.6
Oldham	98,000	35,000	17,000	15,000	0.3
Parmer	446,000	349,000	22,000	339,000	1.2
Randall	289,000	123,000	37,000	77,000	0.8
Sherman	342,000	232,000	21,000	161,000	0.9
Swisher	400,000	278,000	39,000	252,000	1.1
Total	4,873,000	3,198,000	324,000	2,579,000	13.4

T3033/8-21-81

Table 3.3.3.8-3. Cropland acreage in Texas/New Mexico study area counties, 1974 (Page 2 of 2).

County	Total Cropland	Harvested Cropland	Cropland Used Only For Pasture	Land Irrigated	Cropland as Proportion of State Cropland Percentage
New Mexico					
Chaves	95,000	78,000	12,000	84,000	4.3
Curry	426,000	172,000	42,000	145,000	19.4
De Baca	11,000	5,000	4,000	7,000	0.5
Harding	34,000	4,000	11,000	7,000	1.6
Lea	86,000	52,000	20,000	62,000	3.9
Quay	252,000	70,000	43,000	38,000	11.5
Roosevelt	346,000	181,000	58,000	84,000	15.8
Union	90,000	35,000	29,000	27,000	4.1
Total	1,340,000	597,000	219,000	454,000	61.2
Texas/New Mexico Total	6,213,000	3,795,000	543,000	3,033,000	16.1

T3033/8-21-81

Source: U.S. Department of Commerce, 1977a.

Table 3.3.3.8-4. Market value of agricultural products, Texas/New Mexico study area counties, 1974 (Page 1 of 2).

County	Value of Agricultural Products Sold ($1000s)	Value of Crops and Hay (Percent of Total)	Value of Livestock and Livestock Products (Percent of Total)	Value of Other Products (Percent of Total)	Value of Agricultural Products as Proportion of State Total (Percent)
Texas					
Bailey	48,083	39.8	60.2	0.0	0.8
Castro	204,810	30.1	69.7	0.2	3.6
Cochran	33,919	26.5	73.3	0.2	0.6
Dallam	64,233	33.4	66.5	0.1	1.1
Deaf Smith	266,871	19.3	80.7	0.0	4.7
Hale	136,017	50.0	49.9	0.1	2.4
Hartley	80,101	20.7	79.3	0.0	1.4
Lamb	67,734	74.3	25.4	0.3	1.2
Moore	101,819	23.6	76.4	0.0	1.8
Oldham	33,731	6.2	92.3	1.5	0.6
Parmer	261,487	30.9	69.1	0.0	4.6
Randall	107,970	10.6	88.4	1.0	1.9
Sherman	103,445	28.0	71.9	0.1	1.8
Swisher	124,913	28.3	71.6	0.1	2.2
Total	1,635,133	--	--	--	29.0

T3034/8-21-81

Table 3.3.3.8-4. Market value of agricultural products, Texas/New Mexico study area counties, 1974 (Page 2 of 2).

County	Value of Agricultural Products Sold ($1000s)	Value of Crops and Hay (Percent of Total)	Value of Livestock and Livestock Products (Percent of Total)	Value of Other Products (Percent of Total)	Value of Agricultural Products as Proportion of State Total (Percent)
New Mexico					
Chaves	84,146	20.6	79.4	0.0	16.1
Curry	59,479	36.9	63.0	0.1	11.4
DeBaca	6,562	15.3	84.7	0.0	1.2
Harding	5,415	3.3	96.6	0.1	1.0
Lea	24,710	29.8	69.7	0.5	4.7
Quay	27,352	15.8	84.1	0.1	5.2
Roosevelt	38,344	32.9	66.1	1.0	7.3
Union	38,580	8.1	91.8	0.1	7.4
Total	284,588	--	--	--	54.6
Regional Total	1,919,721				13.2

T3034/8-21-81

Source: U.S. Department of Commerce, 1977a.

Table 3.3.3.8-5. Livestock inventories, Texas/New Mexico study area counties (thousands of head).

STATE/COUNTY	CATTLE[1]			SHEEP		
	1969 NUMBER	1974 NUMBER	STATE TOTAL (PERCENT)	1969 NUMBER	1974 NUMBER	STATE TOTAL (PERCENT)
Texas						
Bailey	42	47	0.4	6	3	0.1
Castro	140	166	1.4	6	30	1.0
Cochran	47	30	0.2	1	*	—
Dallam	94	92	0.7	*	*	—
Deaf Smith	305	227	1.7	8	*	—
Hale	101	93	0.7	3	3	0.1
Hartley	53	109	0.8	*	*	
Lamb	51	41	0.3	4	5	0.2
Moore	79	78	0.6	*	*	
Oldham	58	64	0.5	1	1	0.3
Parmer	192	158	1.2	1	3	0.1
Randall	164	96	0.7	4	1	0.03
Sherman	132	99	0.7	*	*	—
Swisher	108	142	1.1	1	1	0.03
Texas Totals	1,575	1,462	10.9	35	47	1.5
STATE/COUNTY	CATTLE			SHEEP		
	1974 NUMBER	1978 NUMBER	STATE TOTAL (PERCENT)	1974 NUMBER	1978 NUMBER	STATE TOTAL (PERCENT)
New Mexico						
Chaves	141	139	9.0	149	110	19.3
Curry	87	100	6.5	4	6	1.1
De Baca	38	39	2.5	19	16	2.8
Harding	47	48	3.1	1	1	0.2
Quay	91	60	3.9	2	2	0.4
Roosevelt	89	66	4.3	3	5	0.9
Union	168	80	5.2	1	1	0.2
New Mexico Totals	661	532	34.3	179	141	24.7

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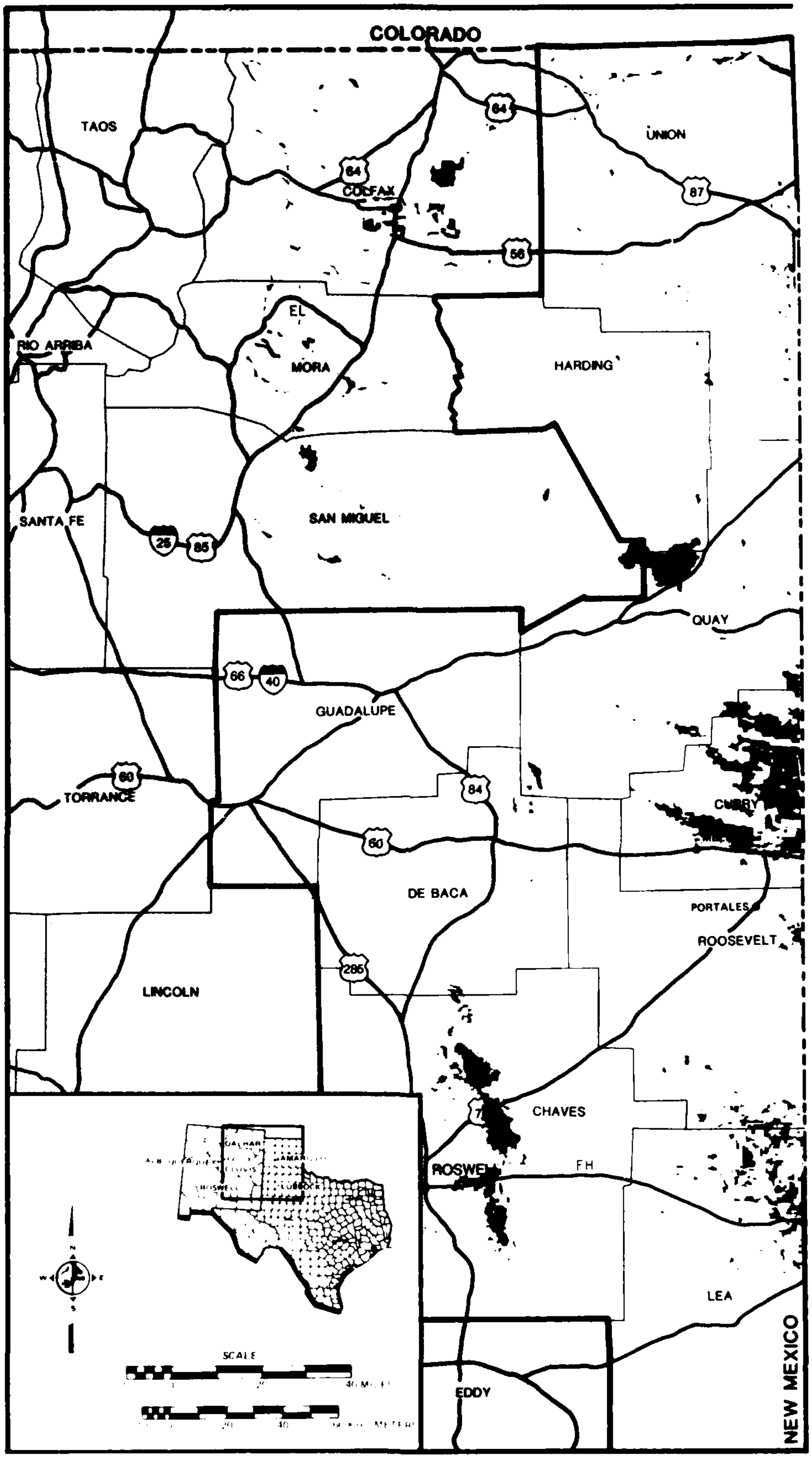
*Less than 500 sheep.

[1]Does not include dairy cattle.

Sources: U.S. Department of Commerce, 1977; University of New Mexico, 1980.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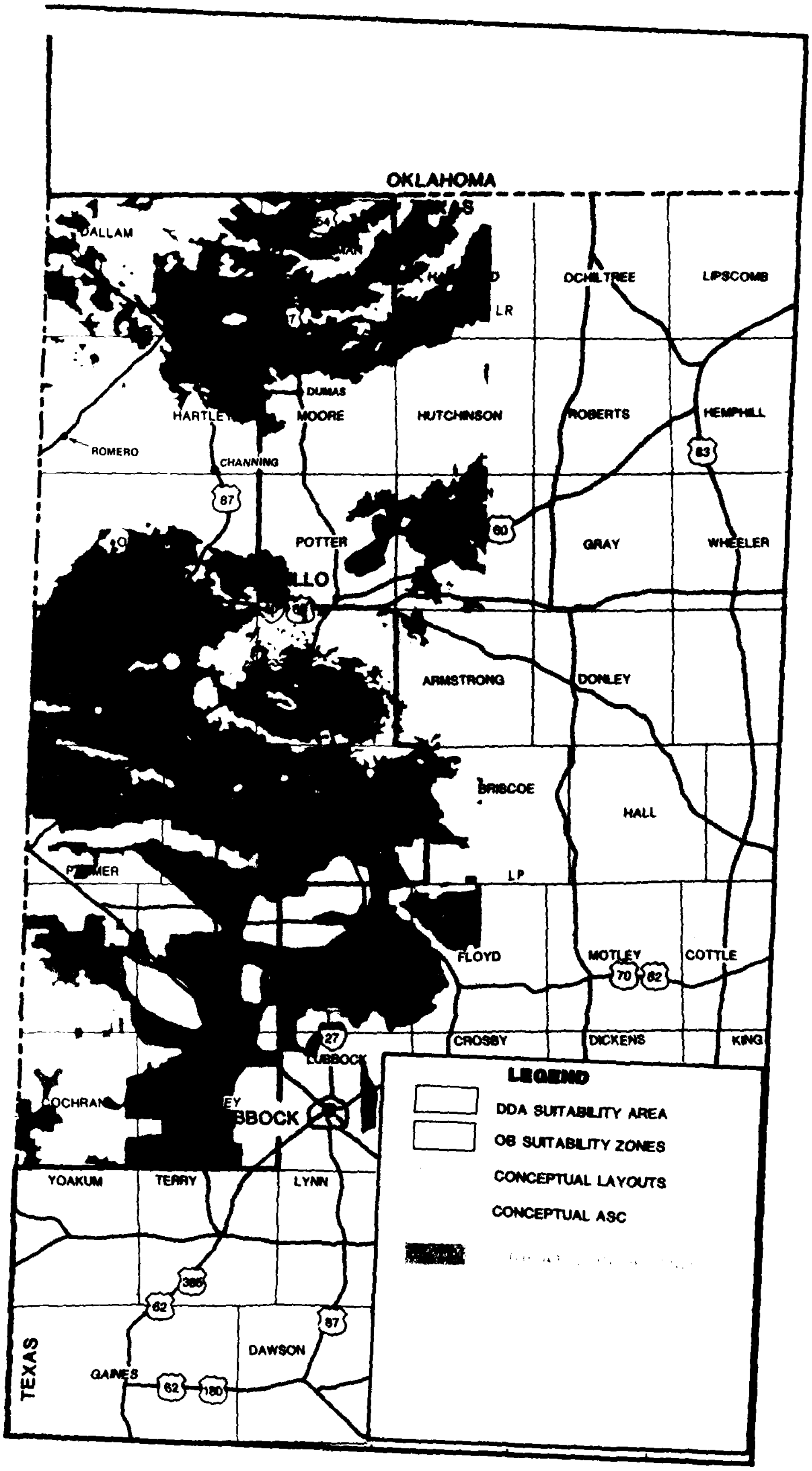


Figure 3.3.3.8-1. Irrigated cropland in the Texas/New Mexico study area. (Source: New Mexico State Engineer, 1968; Panhandle Regional Planning Commission, 1978.)

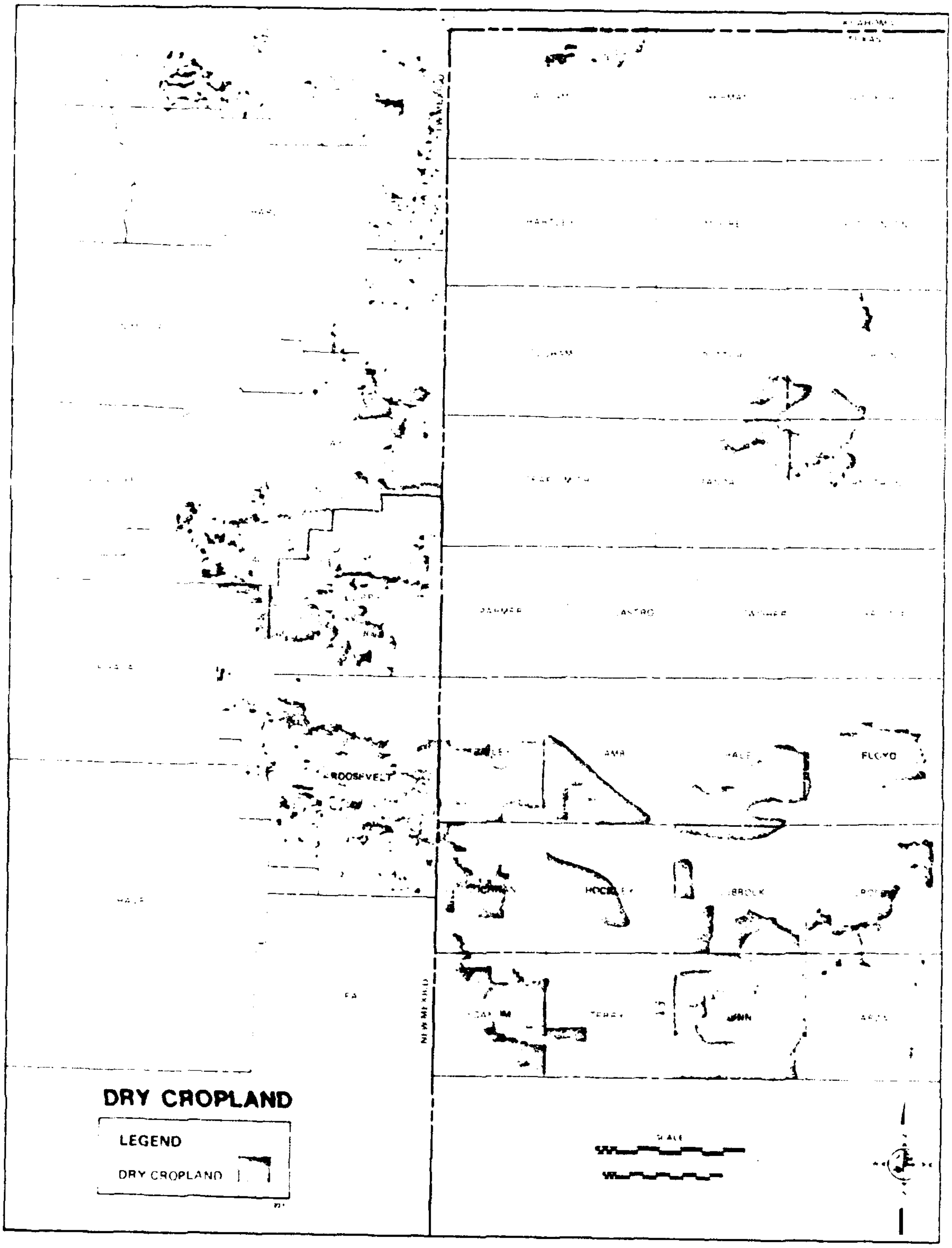


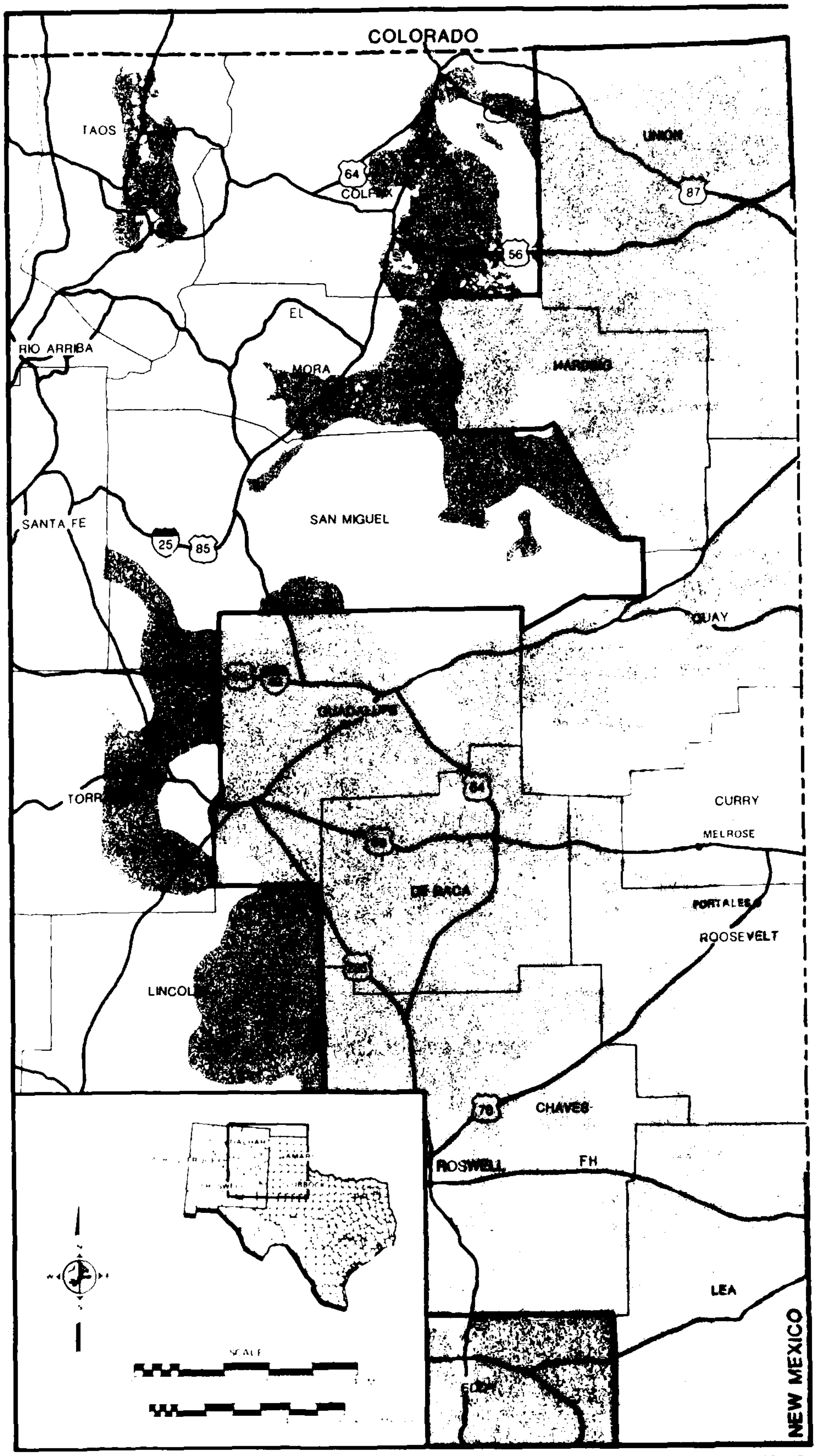
Figure 3.3.3.8-2. Dry cropland in the Texas/New Mexico study area.

Table 3.3.3.8-5a. Dwelling units (DUs) located in Texas/New Mexico region counties and in the rural areas.

County	Total DUs 1980	Rural DUs 1980
Bailey, Tex.	3,151	1,348
Castro, Tex.	3,689	1,421
Cochran, Tex.	1,895	96
Dallam, Tex.	2,804	596
Deaf Smith, Tex.	7,296	1,815
Hartley, Tex.	1,539	548
Hockley, Tex.	8,410	2,194
Lamb, Tex.	6,992	1,928
Oldham, Tex.	797	645
Parmer, Tex.	3,981	1,621
Randall, Tex.	28,544	2,882
Sherman, Tex.	1,286	368
Swisher, Tex.	3,908	1,391
Chaves, N. Mex.	20,823	3,762
Curry, N. Mex.	16,213	2,843
De Baca, N. Mex.	1,350	661
Guadalupe, N. Mex.	2,143	776
Harding, N. Mex.	553	356
Lea, N. Mex.	20,892	3,984
Quay, N. Mex.	4,914	1,124
Roosevelt, N. Mex.	6,510	1,124
Union, N. Mex.	2,271	797

T5086/8-17-81

Source: U.S. Department of Commerce, March 1981.


COLORADO
TAOS
UNION
64
COLFAX
87
56
EL
RIO ARRIBA
MORA
SANTA FE
25
85
SAN MIGUEL
QUAY
CURRY
MELROSE
ROOSEVELT
LINCOLN
CHAVES
ROSWELL
LEA
NEW MEXICO

4461-D

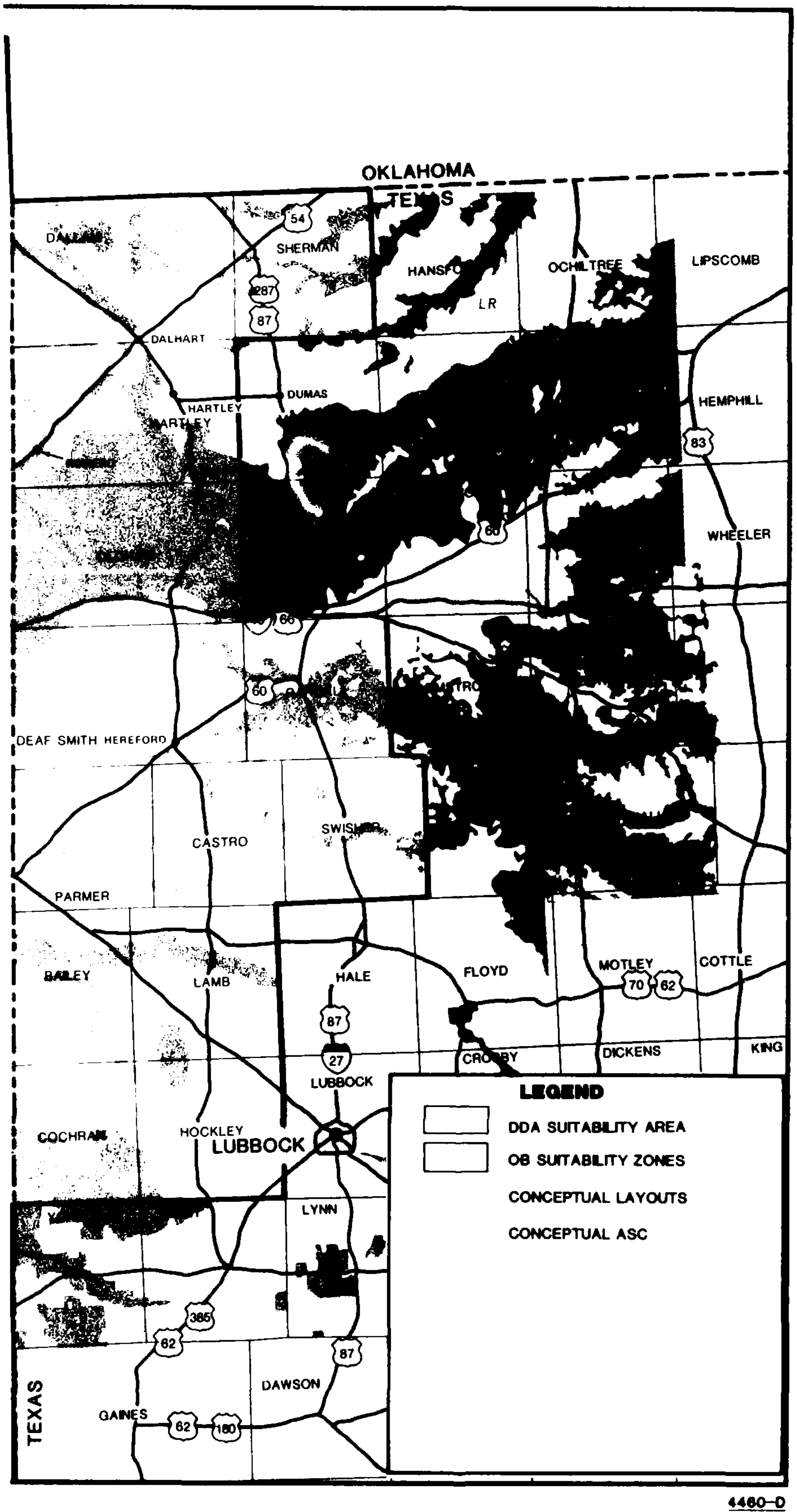
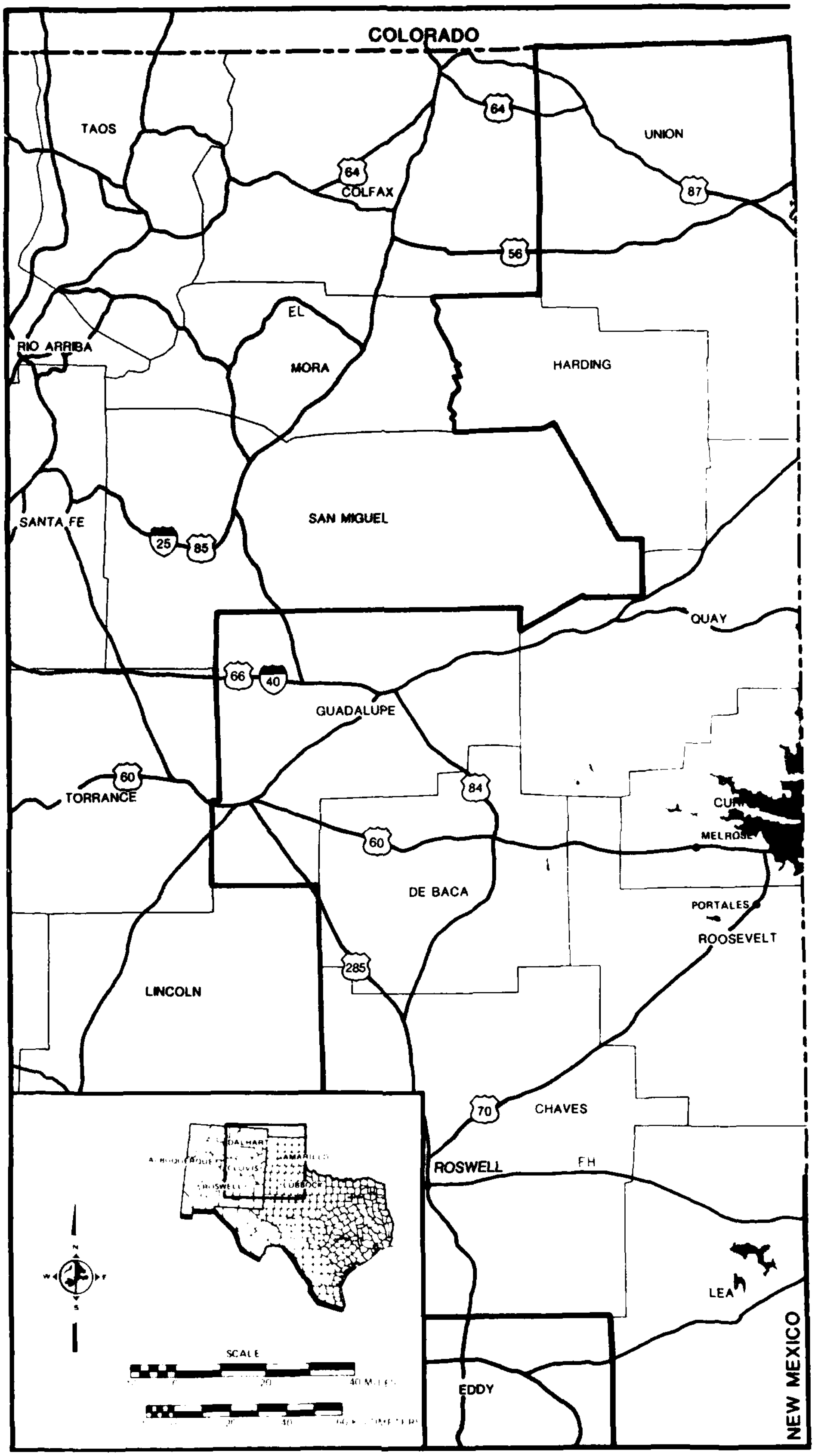


Figure 3.3.3.8-3. Rangeland in the Texas/New Mexico study area. (Source: Eastern Plains Council of Government, 1974; Texas Dept. of Water Resources, 1977.)



COLORADO
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HARDING
SAN MIGUEL
SANTA FE
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85
QUAY
66
40
GUADALUPE
60
TORRANCE
84
MELROSE
DE BACA
PORTALES
ROOSEVELT
285
LINCOLN
70
CHAVES
ROSWELL
LEA
EDDY
NEW MEXICO
SCALE

4461-D

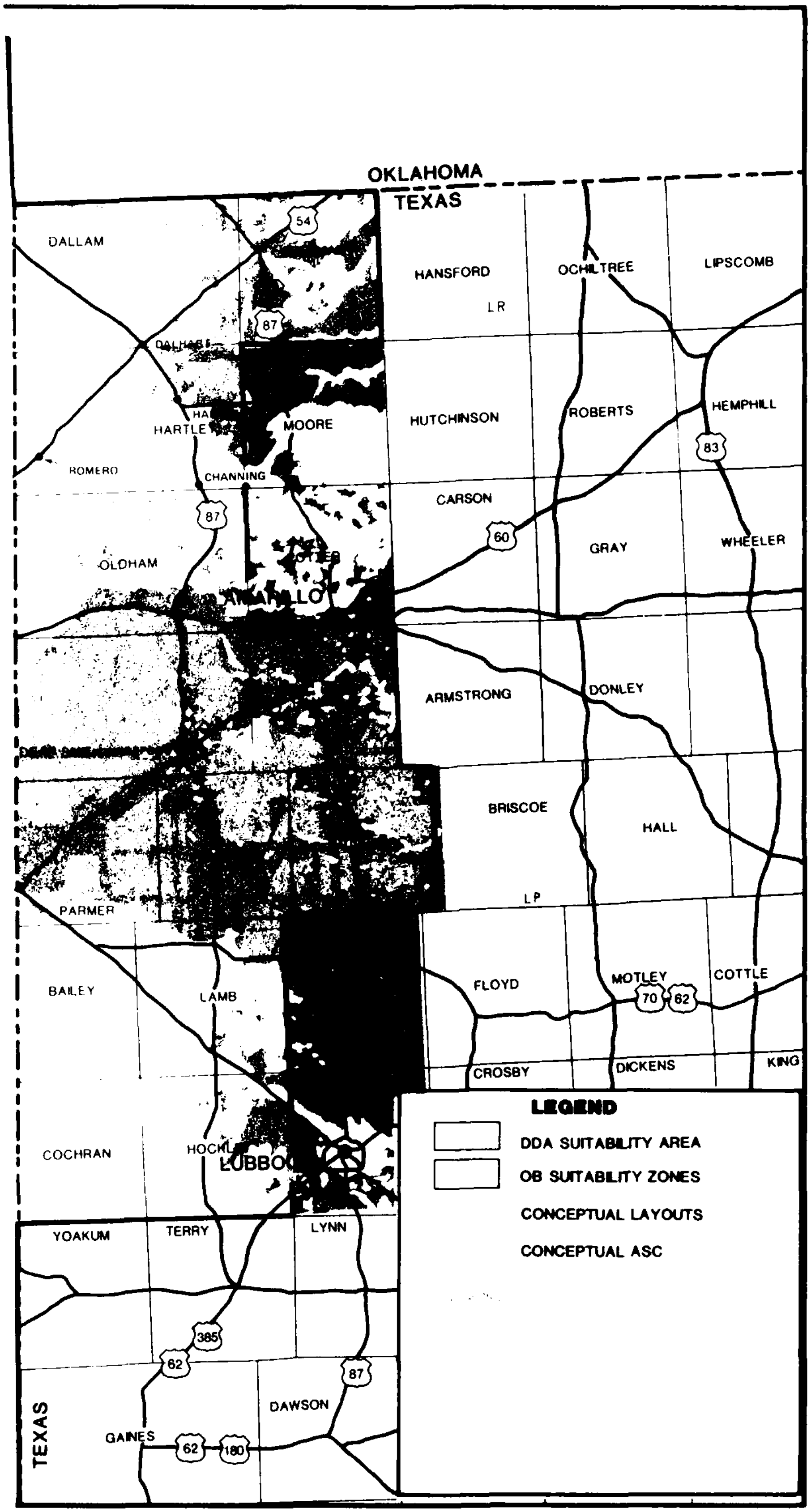

Figure 3.3.3.8-4. Prime farmland in the Texas/New Mexico study area.

Table 3.3.3.8-6. Prime soils inventory, Texas siting region.

County	Total County Land Area (Acres)	Prime Land Acres	Percent of Total County Area	Potential Prime Land Acres	Percent of Total County Area
Bailey	536,800	26,000	4.8	14,000	2.6
Castro	563,200	541,800	96.1	0	0
Cochran	501,100	5,900	1.2	200	0.04
Dallam	956,200	122,300	12.8	0	0
Deaf Smith	966,400	649,900	67.2	0	0
Hartley	952,300	124,100	13.0	0	0
Hockley	581,100	134,100	23.0	0	0
Lamb	654,000	141,900	21.7	300	0.05
Oldham	945,900	162,200	17.1	0	0
Parner	549,600	423,900	77.1	5,400	1.0
Randall	585,000	412,700	70.5	0	0
Sherman	586,200	261,400	44.6	0	0
Swisher	573,200	469,500	81.9	0	0
Totals	8,951,000	3,475,700	38.8	19,900	0.2

T5144/9-13-81/F

Source: U. S. Dept. of Agriculture, March 1980.

New Mexico

The distribution of prime farmland in New Mexico differs radically from that in Texas. Because of the area's greater extent of uniformity in climate, water availability and terrain in Texas, certain soil series have been classified as prime wherever they occur throughout the siting region. In New Mexico, however, the lack of this uniformity, especially water availability, results in only certain locations of a soil series being classified as prime. Only in Curry County has there been an attempt to correlate prime land with soil series and this resulted in only portions of the series being so classified. Potential prime farmland has not been identified and data on prime farmland are available only for Curry, Lea, Quay, and Roosevelt counties. Table 3.3.3.8-7 shows the amount of established prime farmland in these counties.

Recreation

Water-Based Recreation

Swimming, boating, fishing, and waterskiing are the major water-oriented recreational activities in this region. Other recreational activities such as picnicking and hiking are also enhanced by the availability of nearby water. Tables 3.3.3.8-8 and 3.3.3.8-9 list major water bodies available for recreational use other than hunting; these sites are located in Figure 3.3.3.8-5. Lake Meredith is the primary source of water-based recreation in this region of Texas and accommodates almost one-half of the yearly visitors to the federally owned recreation facilities in Texas.

Off-road Vehicle (ORV) Recreation

The Texas portion of the study area is primarily agricultural land and is not generally conducive to extensive ORV activity; in New Mexico, ORV use is much greater. Both the New Mexico State Comprehensive Outdoor Recreation Plan (Scorp, 1967) and the Texas Outdoor Recreation Plan (TORP, 1980, draft) identify trailbike and dune buggy activities (ORV) as low in activity occasions in the study region, although high in other regions of New Mexico. Mescalero Sands in the southern portion of the DDA is the nearest public ORV area in the two states. Additional ORV activity does occur, however, along the river drainages on private land in this region.

Hunting

Big game hunting is not a popular activity because these species are primarily in habitats east or north of the project area. For example, white-tailed deer population estimates range from zero in 13 of the 15 High Plains counties of Texas to 50 in Moore and Randall and 200 in Potter counties (Texas Parks and Wildlife Dept., 1980). An annual aerial census of pronghorn antelope shows that the bulk of the herd is found in the northern portion of the project area, in Oldham, Hartley, Dallam, Union, Harding and Potter counties (Kothmann, H. G., 1980). An inventory of the big game in the High Plains Red River drainage area is shown in Table 3.3.3.8-10.

Table 3.3.3.8-7. Prime soils inventory, New Mexico siting region.

County	Total County Land Area (Acres)	Prime Land (Acres)	Percent of Total County Area
Curry	897,900	133,700	14.9
Lea	2,810,900	32,800	1.2
Quay	1,840,000	6,900	0.4
Roosevelt	1,570,600	9,600	0.6
Total	7,119,400	183,000	2.5

T5145/9-13-81/F

Source: U.S. Department of Agriculture, various dates.

Table 3.3.3.8-8. Recreational lakes and streams in the New Mexico study area.

County	Streams	Lakes with Greater than 40 Surface Acres
Chaves	Rio Penasco (40 mi) Rio Hondo (47 mi) Rio Felix (4 mi) Pecos (118 mi)	Bitter Lake (7) Two Lakes Reservoir Roswell Saline Zuber Lake Lake Van
Curry		Ned Houk Reservoir
DeBaca	Pecos (80 mi)	Red Lake Alamogordo Res.
Quay	Canadian River (50 mi)	Ute Reservoir Tucumcari Lake Hudson Lake
Union	Perico Cimarron River (25 mi) Carrizozo North Canadian (Seneca) Carrizo Ute Tramperos	Pasamonte Lake Clayton Lake

T2804/9-21-81

Source: Warren J. McNall, personal communication, 1981.

Table 3.3.3.8-9. Major recreational lakes and streams in the Texas study area.

County	Streams	Lakes
Bailey	Blackwater	Coyote Lake
Castro	Running Water Frio	
Cochran	Sulphur Draw	
Dallam	Carrizo Mustang (West Rita Blanca) Cold Water	
Deaf Smith	Palo Duro Tierra Blanca Frio	
Hale	Blackwater Running Water	
Hartley	Punta de Agua Rita Blanca	Lake Rita Blanca
Lamb	Blackwater Running Water	Bull Lake Yellow Lake (Portion)
Moore	S. Palo Duro	Lake Meredith (portion)
Oldham	Rita Blanca Canadian	
Parmer	Frio Running Water	
Randall	Palo Duro Tierra Blanca	Buffalo Lake
Swisher	Tule	

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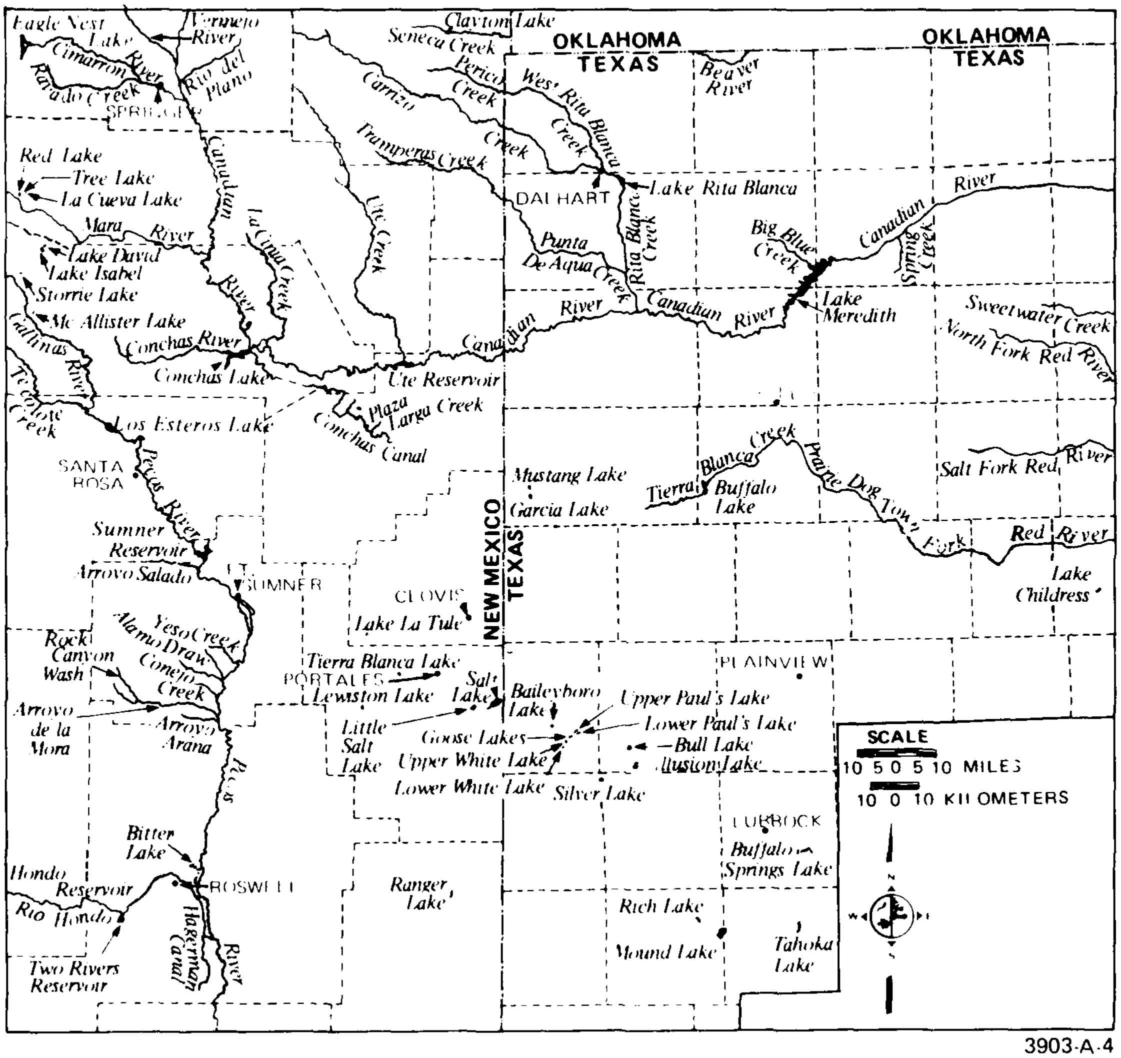


Figure 3.3.3.8-5. Areas of water-based recreation in the Texas/New Mexico study area.

Table 3.3.3.8-10. Wildlife inventory estimates in the High Plains drainage area of the Red River[1].

Species	Habitat (Acres)	Total Population
White-Tailed Deer	55,850	30
Mule Deer	73,260	380
Aoudad (Barbary Sheep)	55,850	150
Pronghorn	-	-
Rio Grande Turkey	72,330	130
Ring-Necked Pheasant	1,239,770	47,850
Lesser Prairie Chicken	-	-
Quail	2,578,830	23,200
Mourning Dove	3,070,000	185,520
Fox Squirrel	23,040	90
Ducks	35,370	176,850
Geese	35,370	35,370

T2817/9-5-81/F

[1]From U.S.D.A., Special Report, 1976.

The Rio Grande turkey population in the High Plains habitat area is small and confined to Randall and Swisher counties in Texas; however, in the northeastern area of New Mexico, turkeys are more common.

The introduced ring-necked pheasant population thrives on the croplands of the High Plains, with signficant populations in Deaf Smith County, Texas and Curry County, New Mexico. The mourning dove population is low because of lack of cover and diversity of habitat. Fox squirrel habitat is insignificant. Rabbits are not considered game animals in Texas. The eastern cottontail is distributed widely, whereas the blacktailed jackrabbit and desert cottontail increase in abundance in the open western areas.

Ponds and playas that remain wet for at least 60 percent of the time are habitat for waterfowl. Canada geese are the most numerous, with a few snow geese and a small number of white-fronted geese. Most of the waterfowl are ducks, primarily mallard, wigeon, pintail, and green-winged teal.

Fishing

Ponds, playas, and lakes under 40 surface acres are the primary fishing habitat. In a special 1976 report prepared by the U.S. Department of Agriculture in cooperation with several Texas agencies, it was assumed that ponds are primarily on private lands generally not open for public use, and that only 48 percent of the fishing habitat in the High Plains is accessible for public use. The report suggests a need for more surface acres of lakes in the High Plains to meet the fishing demand, ranging from a need for 1,600 surface acres in 1975 to 2,500 acres in 2020.

Snow-Related Activities

Cross-country skiing, snow-mobiling, snow-skiing, and sledding hold relatively low recreational priorities primarily because of the absence of quality snow-play areas nearby. Most snow-play areas occur farther than 150 mi from the key population centers.

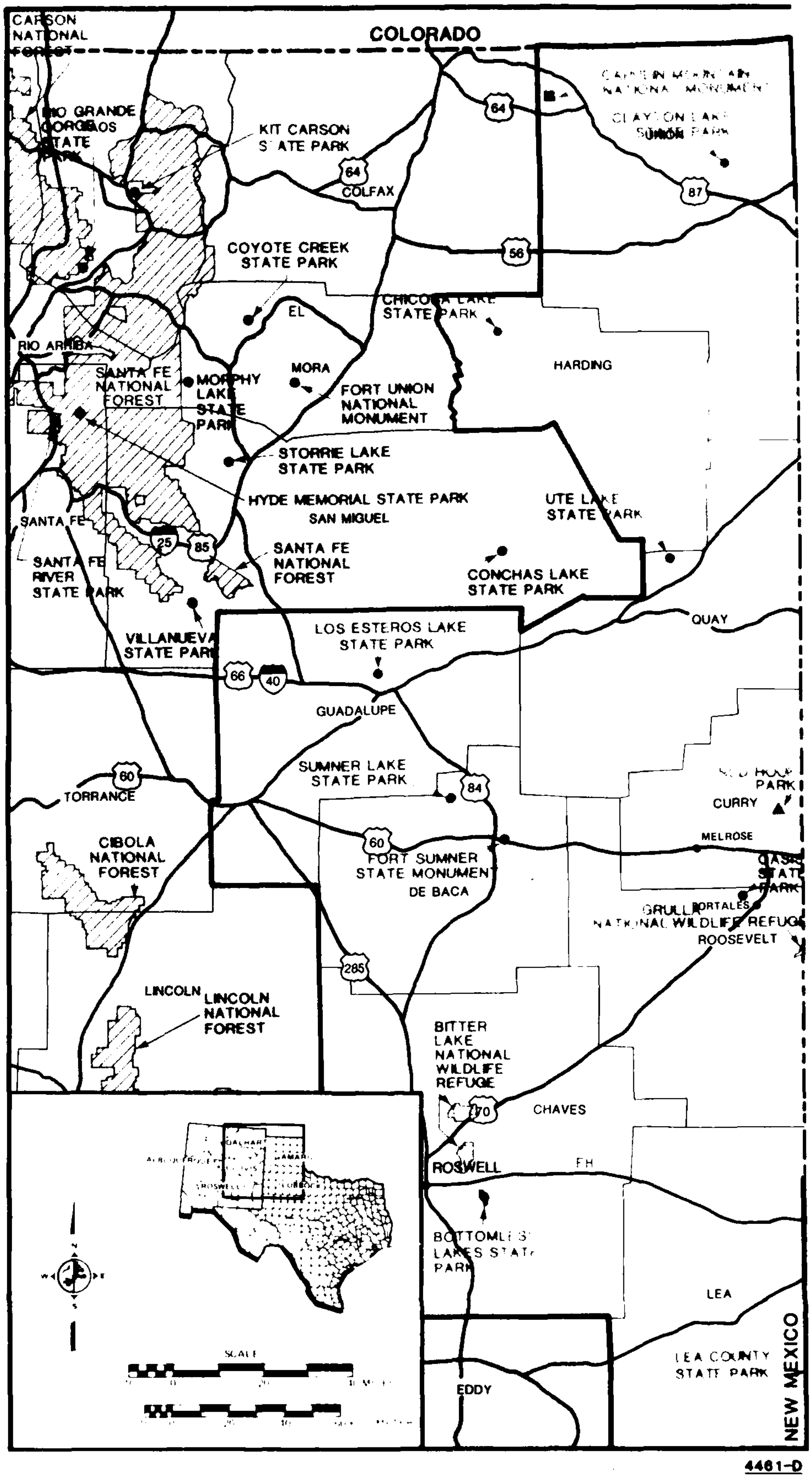
Campgrounds and Major Parkland Areas

Major recreational areas proximal to potential deployment areas are shown in Figure 3.3.3.8-6. Most of the major parklands and recreational facilities are found on the periphery of the study area. The distribution of these areas by county, and the managing and/or operating agency, are shown in Tables 3.3.3.8-11 and 3.3.3.8-12. Most parklands are associated with water bodies, particularly state parks. All major parks are situated close to major transportation corridors.

Native American Resources (3.3.3.9)

Cultural Resources (3.3.3.9.1)

The area was sporadically occupied in late prehistoric and early historic times by Jumano (Wichita) Apache, Comanche Kiowa, and Kiowa Apache peoples who hunted for large game. Due to the highly mobile nature of these populations and the intertribal competition for bison and other food resources of the region, tribal


COLORADO
CARSON NATIONAL FOREST
RIO GRANDE GORGE STATE PARK
TAOS
KIT CARSON STATE PARK
COLFAX
COYOTE CREEK STATE PARK
CHICOSA LAKE STATE PARK
CLAYTON LAKE STATE PARK
UNION
RIO ARRIBA
SANTA FE NATIONAL FOREST
MORPHY LAKE STATE PARK
MORA
FORT UNION NATIONAL MONUMENT
HARDING
STORRIE LAKE STATE PARK
HYDE MEMORIAL STATE PARK
SAN MIGUEL
UTE LAKE STATE PARK
SANTA FE
SANTA FE RIVER STATE PARK
SANTA FE NATIONAL FOREST
CONCHAS LAKE STATE PARK
VILLANUEVA STATE PARK
LOS ESTEROS LAKE STATE PARK
QUAY
GUADALUPE
TORRANCE
SUMNER LAKE STATE PARK
CURRY
MELROSE
CIBOLA NATIONAL FOREST
FORT SUMNER STATE MONUMENT
DE BACA
PORTALES
ROOSEVELT
LINCOLN
LINCOLN NATIONAL FOREST
BITTER LAKE NATIONAL WILDLIFE REFUGE
CHAVES
ROSWELL
LEA
LEA COUNTY STATE PARK
EDDY
NEW MEXICO
SCALE
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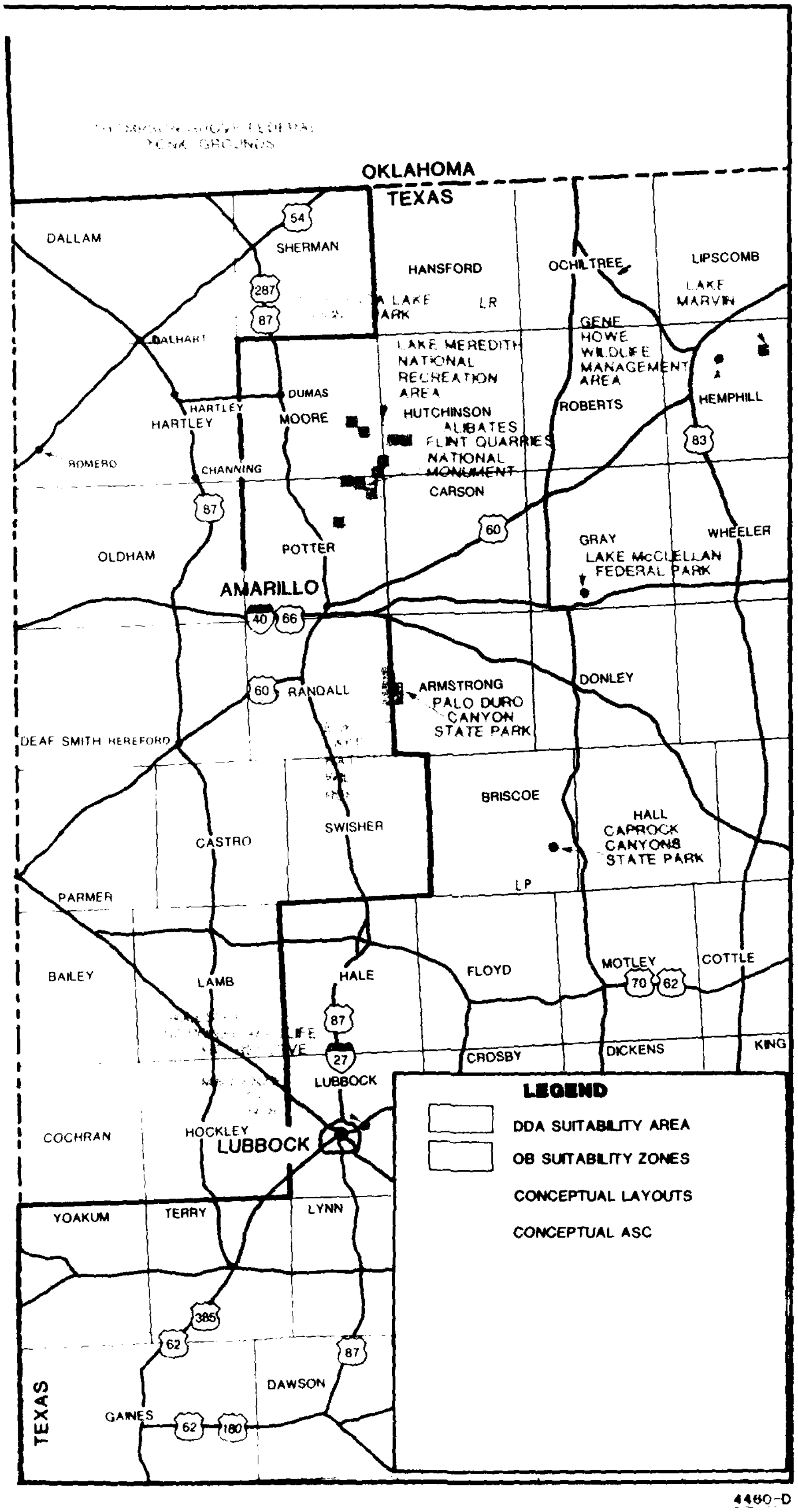

Figure 3.5.3.8-6. Recreational areas in the Texas-New Mexico study area.

Table 3.3.3.8-11. Major parklands and recreational facilities in New Mexico study area.

County	Administering Agency	Park/Area Name
Chaves	New Mexico Parks and Recreation Division	Bottomless Lakes State Park
	U.S. Fish and Wildlife Service	Bitter Lake National Wildlife Refuge
	U.S. Forest Service	Lincoln National Forest (portion)
Curry	City of Clovis	Ned Houk Memorial Park
DeBaca	New Mexico Parks and Recreation Division	Sumner Lake State Park
Harding	New Mexico Parks and Recreation Division	Chicosa Lake State Park
	U.S. Forest Service	Kiowa National Grasslands (portion)
Lincoln	New Mexico Parks and Recreation Division	Smokey Bear State Park Valley of Fires State Park
Otero	New Mexico Parks and Recreation Division	Oliver Lee Memorial State Park
Quay	New Mexico Parkland Recreation Division	Ute Lake State Park
Roosevelt	New Mexico Parks and Recreation Division	Oasis State Park
	U.S. Fish and Wildlife Service	Grulla National Wildlife Refuge
San Miguel	New Mexico Parks and Recreation Division	Conchas Lake State Park
	New Mexico Parks and Recreation Division	Storrie Lake State Park
	New Mexico Parks and Recreation Division	Villanueva State Park
	U.S. Forest Service	Santa Fe National Forest (portion)
	U.S. Fish and Wildlife Service	Las Vegas National Wildlife Refuge
Santa Fe	New Mexico Parks and Recreation Division	Santa Fe River State Park Hyde Memorial State Park
Taos	New Mexico Parks and Recreation Division	Kit Carson State Park Rio Grande Gorge State Park
Union	New Mexico Parks and Recreation Division	Clayton Lake State Park
	National Park Service	Capulin Mountain National Monument
	U.S. Forest Service	Kiowa National Grasslands (portion)

T2864/10-2-81

Source: New Mexico State Comprehensive Outdoor Recreation Plan 1976; State Parks for New Mexico's Future 1975; Rand McNally Road Atlas, (U.S., Canada, Mexico).

Table 3.3.3.8-12. Major parklands and recreational facilities in Texas study area counties.

County	Administering Agency	Park/Area Name
Dallam	U.S. Forest Service	Rita Blanca National Grasslands
Sherman	No major parklands	
Moore	National Park Service	Lake Meredith National Recreation area (portion)
Potter	National Park Service	Lake Meredith National Recreation Area (portion)
	National Park Service	Alibates Flint Quarries National Monument
Oldham	No major parklands	
Deaf Smith	No major parklands	
Randall	U.S. Fish and Wildlife Service	Buffalo Lake National Wildlife Refuge
	Texas Department of Parks and Wildlife	Palo Duro Canyon State Park (portion)
Parmer	No major parklands	
Castro	No major parklands	
Swisher	No major parklands	
Briscoe	Texas Department of Parks and Wildlife	Caprock Canyon State Park
Bailey	U.S. Fish and Wildlife Service	Muleshoe National Wildlife Refuge
Lamb	No major parklands	

T2865/9-23-81/F

Source: Rand McNally Road Atlas (U.S., Canada, Mexico).

boundaries cannot be drawn. Territorial claims of Apache and Comanche Indians have fluctuated over time.

Sacred Areas

Petroglyph sites are recorded for Winkler, Briscoe, Motley, Randall, Potter, Armstrong, and Oldham counties. Caves, rockshelters, and rock crevices were favored for internments, and graves associated with the Apache and Comanche are known in Lubbock, Garza, and Crosby counties.

Also, sacred significance is attached to established trails and to rock cairns or shrines erected for ceremonial purposes along these trails. The removal of Apache and Comanche peoples from these ancestral lands has eroded tribal knowledge of traditional sites and features, and locations are poorly documented.

Native American Land/Water Resources (3.3.3.9.2)

Texas/New Mexico

There are no known or identified Native American land or water resources in the Texas/New Mexico study area.

Socioeconomic Characteristics (3.3.3.9.3)

There are no Native American reservations or colonies in the Texas/New Mexico study area.

Archaeological and Historical Resources (3.3.3.10)

National and State Register Properties (3.3.3.10.1)

In the Texas/New Mexico study area, there is a wide variety of properties on the National Register of Historic Places. These properties are illustrated in Figure 3.3.3.10-1 or listed in the associated Table.

Register properties are to be found in both rural and urban areas. Historic or architecturally significant buildings are likely to be found within city limits, such as the E. B. Black House in Deaf Smith County, Texas. Archaeological sites are more commonly found in less populated areas, as exemplified by the Rocky Dell and Landergin Mesa sites in Oldham County.

Archaeological Resources (3.3.3.10.2)

Although the Texas/New Mexico southern high plains show evidence of human occupation for at least the last 13,000 years, they have never been the focus of a systematic regional archaeological investigation. Statements about the type and distribution of archaeological resources are, therefore, necessarily preliminary.

The study area comprises most of the region known as the Southern High Plains, and can be divided into four geographically, and, to some extent, culturally, distinct areas (Figure 3.3.3.10-2). These are the Panhandle High Plains of Oklahoma

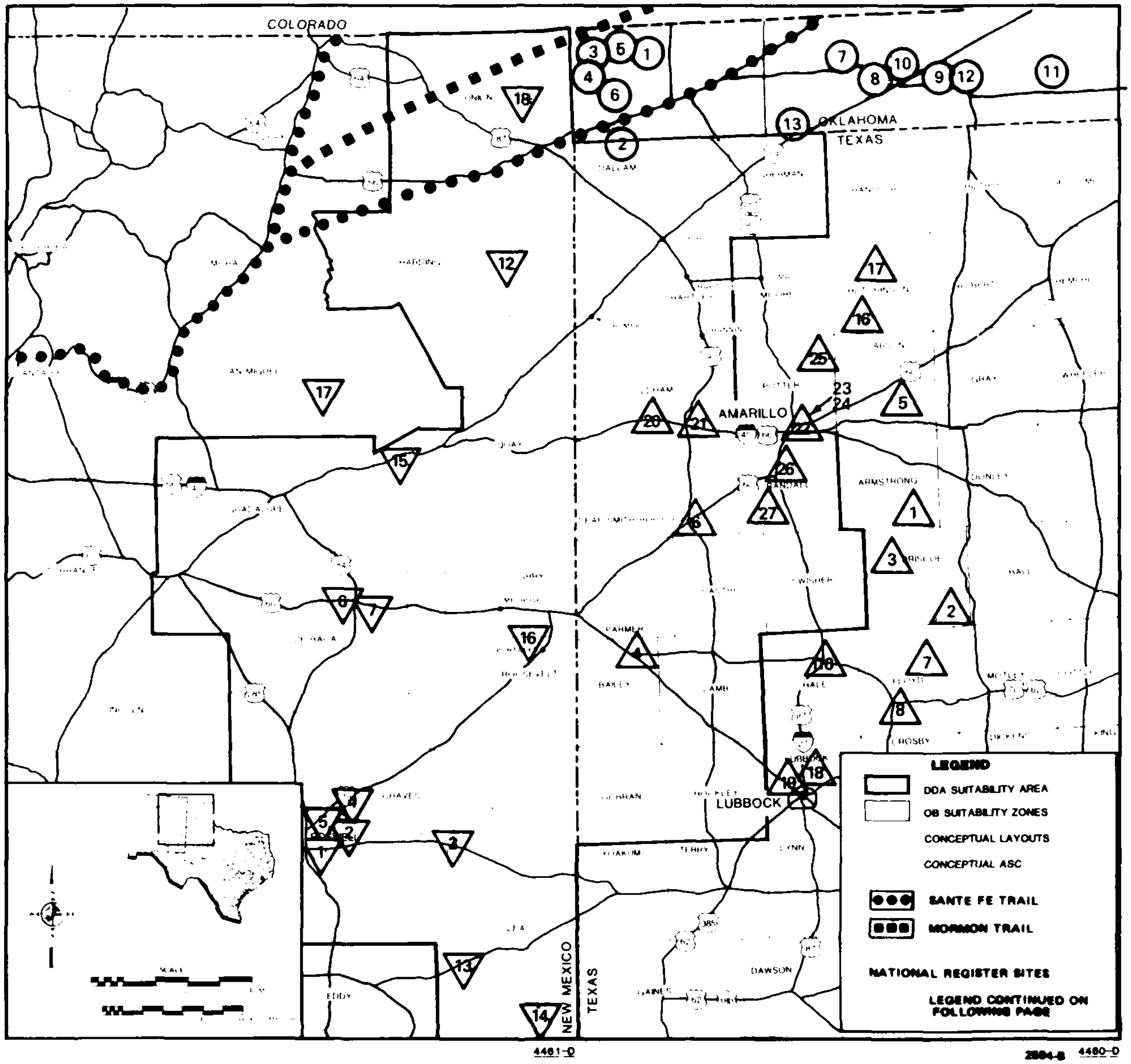

Figure 3.3.3.10-1. National Register sites in the Texas/New Mexico study area.

LEGEND

NATIONAL REGISTER OF HISTORIC PLACES

OKLAHOMA

TEXAS COUNTY
7 SHORES ARCHAEOLOGICAL SITE
8 EASTERWOOD ARCHAEOLOGICAL SITE
9 NASH II CLAWSON ARCHAEOLOGICAL SITE
10 TWO SISTERS ARCHAEOLOGICAL SITE
11 OLD HARDESTY
12 STAMPER SITE
13 JOHNSON-CLINE ARCHAEOLOGICAL SITE

CIMARRON COUNTY
1 BLACK MESA
2 CEDAR BREAKS ARCHAEOLOGICAL DISTRICT
3 BAT CAVE ARCHAEOLOGICAL SITE
4 RED GHOST CAVE ARCHAEOLOGICAL DISTRICT
5 THREE ENTRANCE CAVE ARCHAEOLOGICAL DISTRICT
6 CAMP NICHOLS

NEW MEXICO

CHAVES COUNTY
1 HONDO RESERVOIR
2 ARCHAEOLOGICAL SITE AR 30 6 1047
3 MESCALERO SANDS
4 BITTER LAKE GROUP
5 JAMES PHELPS WHITE HOUSE

DE BACA COUNTY
6 FORT SUMNER RAILROAD BRIDGE
7 FORT SUMNER RUINS

EDDY COUNTY
8 ARCHAEOLOGICAL SITE 30 6 1034*
9 MAROON CLIFFS ARCHAEOLOGICAL DISTRICT*
10 FIRST NATIONAL BANK OF EDDY*
11 CARLSBAD RECLAMATION PROJECT*

HARDING COUNTY
12 BUEYEROS SHORT GRASS PLAINS

LEA COUNTY
13 BAISH OIL WELL NUMBER ONE
14 ARCHAEOLOGICAL SITE AR 30 630 AND AR 7 73

QUAY COUNTY
15 RICHARDSON STORE

ROOSEVELT COUNTY
16 ANDERSON BASIN (BLACKWATER DRAW)

SAN MIGUEL COUNTY
17 BELL RANCH HEADQUARTERS

UNION COUNTY
18 RABBIT EARS (CLAYTON COMPLEX)

TEXAS

ARMSTRONG COUNTY
1 J A RANCH

BRISCOE COUNTY
2 LAKE THEO FOLSOM COMPLEX
3 MAYFIELD DUGOUT

BAILEY COUNTY
4 MULESHOE NATIONAL WILDLIFE REFUGE

CARSON COUNTY
5 CARSON COUNTY SQUARE HOUSE MUSEUM

DEAF SMITH COUNTY
6 E B BLACK HOUSE

FLOYD COUNTY
7 QUITAQUE RAILWAY TUNNEL
8 FLOYDADA COUNTRY CLUB SITE

GARZA COUNTY
9 OLD ALGERITA HOTEL*
10 OLD POST SANITARIUM*
11 COOPER'S CANYON SITE*
12 O S RANCH PETROGLYPHS*
13 POST MONTGOMERY SITE*
14 POST WEST DUGOUT*

HALE COUNTY
15 PLAINVIEW SITE

HUTCHINSON COUNTY
16 ANTELOPE CREEK ARCHAEOLOGICAL DISTRICT
17 ABODE WALLS

LUBBOCK COUNTY
18 CANYON LAKES ARCHAEOLOGICAL DISTRICT
19 LUBBOCK LAKE SITE

OLDHAM COUNTY
20 ROCKY DELL
21 LANDERGIN MESA

POTTER COUNTY
22 BIVENS HOUSE
23 LANDERGIN HARRINGTON HOUSE
24 MCBRIDE RANCHHOUSE
25 ALIBATES FLINT QUARRIES AND TEXAS PANHANDLE PUEBLO CULTURE NATIONAL MONUMENT

RANDALL COUNTY
26 L T LESTER HOUSE
27 HIGH PLAINS NATURAL AREA

*NOT ILLUSTRATED ON MAP

2594-B-3

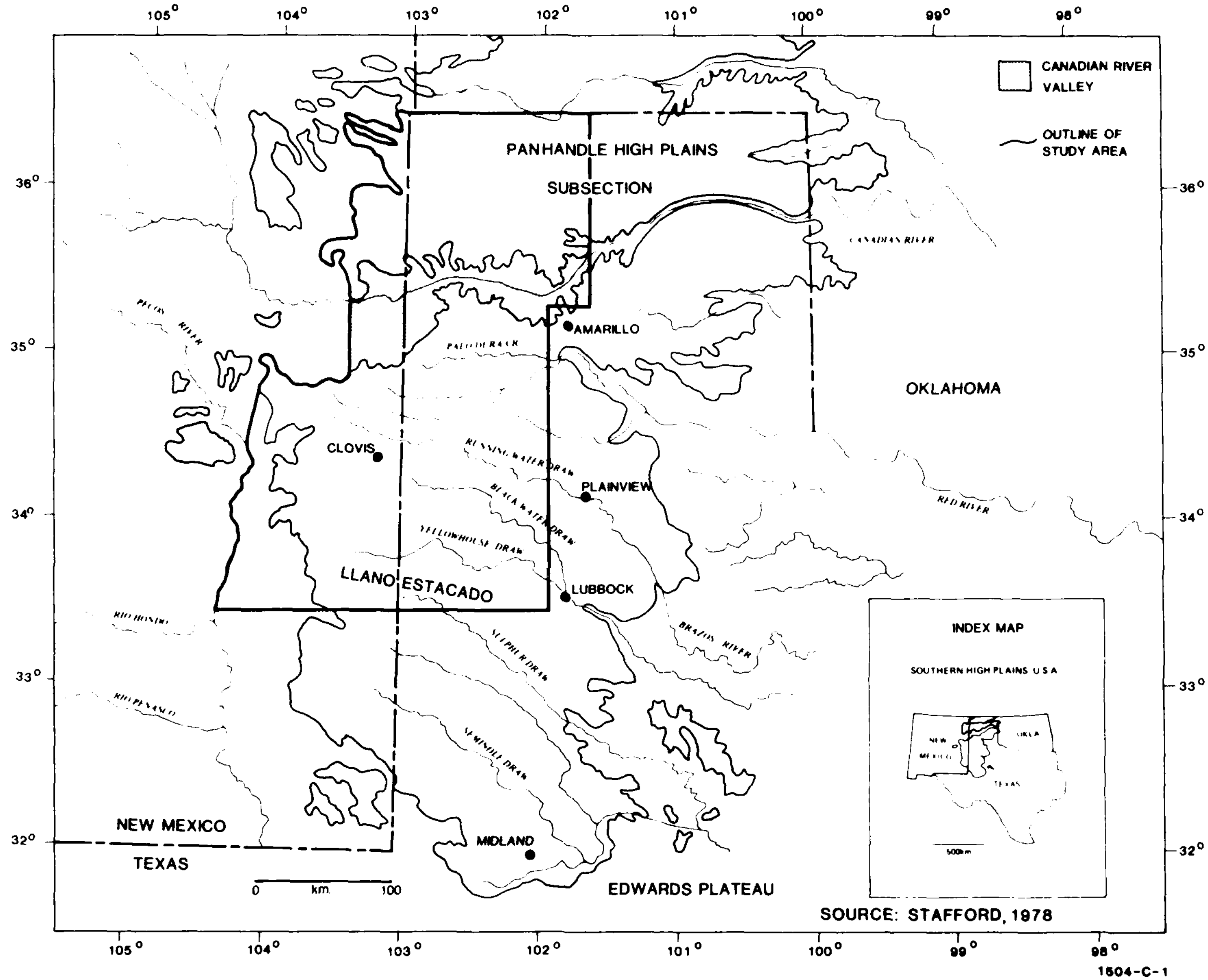

Figure 3.3.3.10-2. Geographically distinct areas of the Southern High Plains.

and Texas, the Canadian River Valley, the Llano Estacado, or Staked Plains, and the Pecos River Valley (Jelinek, 1967; Stafford, in press; Wedel, 1961).

The largest of these areas is the Llano Estacado. It is customary to divide Llano cultural history into four periods (Collins, 1971; Suhm et al., 1954): Paleo-Indian (10,000 B.C. to ca. 5,000 B.C.), Archaic (ca. 5,000 B.C. to A.D. 500), Neo-Indian (A.D. 500 to A.D. 1541), and Historic (after A.D. 1541). Archaeological work in the Llano Estacado has focused largely on the Paleo-Indian period. This period is poorly understood in most of North America, and the relatively extensive work in the Llano has made major contributions to our knowledge. The potential for studying Paleo-Indian adaptations in the area is demonstrably high. Other, later cultural periods are poorly known, however. The prehistoric inhabitants of most of the area, in all periods, were nomadic hunter-gatherers relying heavily on bison, although there is evidence for sedentary or semi-sedentary agriculturalists (Krieger, 1946) or hunter-gatherers (Collins, 1968) in some areas. Current evidence suggests that aboriginal activities during all periods were greatly affected by the availability of the limited supply of water; both for the inhabitants themselves, and because watered areas attract game animals and are sources for a wide variety of vegetable resources (Johnson, in press; Stafford, in press; Thoms and Montgomery, 1976).

Several lines of geological, palynological, and archaeological evidence suggest that the Paleo-Indian period was followed by an extremely hot, dry interval generally called the Altithermal, lasting from roughly 7000 to 5000 B.C., (Haynes, 1975; Reeves, 1969; Oldfield and Schoenwetter, 1975; Evans, 1951). This period, and the rest of the Archaic as well, is marked by a near void in the archaeological record. The implication is partial or total abandonment of much of the Llano until after A.D. 0 (Collins, 1971; Johnson, in press; Stafford, in press). Although at least some of the draws maintained a water supply, particularly in their eastern portions (Johnson, in press), the virtually complete absence of bison from the Llano, reflected in archaeological (Dillehay, 1974) and non-archaeological contexts during this period may have been a major barrier to human occupation there. However, Archaic remains, mainly in the form of projectile points, are known from the Llano (Collins, 1971; Hester, 1972; Wheat, 1974). Occupation may have increased in the later, post-Altithermal Archaic (Willey and Hughes, 1978) contemporary with, and possibly related to, the reappearance of bison on the South Plains (Dillehay, 1974). The Llano Estacado may have been largely a hunting area during the Archaic, reached by groups from adjacent areas possibly mainly the east, (Hughes and Willey, 1978), through the reentrant canyons in the escarpments (Thoms and Proctor, 1977). The possibility of hundreds of unreported Archaic sites (Hughes and Willey, 1978:27) indicates that much remains to be learned about this period. Permanent water was available in a number of lakes and eastward flowing draws. The Llano from 12,000 to 7,000 B.C. was better watered than at present. As Hester (1975) shows, 84 percent of the Paleo-Indian sites known from the Llano and nearby areas are associated with water sources. This figure may overestimate the effect of water on site location because the draws and lake/playa merging of the Llano are the most likely places for sites to be preserved (particularly the draws - Stafford, 1978), and are its most intensively surveyed parts (Campbell and Judd, 1977). However, it also reflects the known distribution of resources and the pattern of Paleo-Indian settlement elsewhere on the Great Plains (Wendorf and Hester, 1962).

Types of sites associated with these areas include camps, kill sites, and isolated artifacts. Kill sites, in particular, are also known from natural traps which

may or may not be close to water (e.g., Frison, 1974, 1978; Hughes and Willey, 1978).

The exact nature of the Paleo-Indian occupation on the Llano is unknown at this time. Some investigators have stated that the area was used for periodic hunting rather than permanent habitation (Thoms and Proctor, 1977), while others have attempted to define discrete band territories centered on the Llano itself (Hester and Grady, 1977). This remains a critical research problem.

The Neo-Indian period shows evidence of a major resurgence of population. There appear to be two major categories of Neo-Indian occupation: sites with ceramics typical of the Panhandle Aspect peoples to the north (see below), and sites with ceramics typical of the Puebloan peoples to the west. These sites appear to be temporary bison hunting camps (Honea, 1973), although Krieger (1946) has suggested that the Puebloan sites are the remnants of permanent or semi-permanent agricultural villages in sandy areas. This hypothesis has been challenged by Collins (1968), who excavated the Salt Cedar Site on the Southern Llano and found Puebloan ceramics, frequent bison remains, and no evidence for agriculture. Collins suggests that this site was occupied by sedentary or semi-sedentary bison hunters with Puebloan affiliations, possibly from the Pecos River Valley. Very little is known about settlement patterns on the Llano from approximately A.D. 1000 to A.D. 1400, although the Salt Cedar Site is on the edge of the bed of Andrews Lake. Krieger reported that Archaic sites are associated with one or another of the draws or streams, and it may be that the upland playas and lakes were largely or completely dry, and so were unattractive for even limited occupation. This would be expected in light of the regional drop in the water table which has been noted (Haynes, 1975).

The occupants of the Llano at the beginning of the Historic period were apparently the Apache, arriving in the early 1500's (Gunnerson, 1974). Although the Apache were nomadic hunters when the Spanish first arrived, they developed small seasonal farming villages, principally along major drainage routes to the north of the Llano. By the end of the 17th century, a number of their campsites are known (Collins, 1971; Johnson et al., 1977; Runkles, 1964). The Apache were replaced by the Comanche, who were purely nomadic, mounted, predatory bison hunters, by the mid-18th century. By this time, the Llano was probably occupied seasonally, although hunting and trading parties probably passed across it year-round (Newcomb, 1961; Wallace and Hoebel, 1952). The Comanche were defeated on their wintering grounds in Palo Duro Canyon in 1874 and put onto reservations (Hughes and Willey, 1978).

Three types of sites can be defined in all periods: kill and butchering sites, habitation sites, and isolated artifacts. Kill sites, usually of bison, are frequently associated with water and may be accompanied by camps (cf. Bamforth, 1980; Hester, 1972, 1975). Habitation sites may be only a small camp from a hunting party, a larger band camp, or a permanent or semi-permanent village. Isolated artifacts may be found throughout the study area.

In sum, the archaeological resources on the Llano Estacado are a unique data base for archaeologists. Its economic importance to a wide variety of poorly known cultures along its margins for the past 12,000 years, and the possibility in the past of unique adaptations to the Llano itself, make it a valuable, largely untapped laboratory for the study of a wide variety of archaeological problems.

While archaeological research on the Llano has concentrated on the Paleo-Indian period, in the Canadian River Valley it has focused on sedentary agricultural occupation in later periods. The area contains no known Paleo-Indian sites, although some are adjacent to it (Roberts, 1942). If present, the locations of Paleo-Indian sites in the valley are probably similar to those above. The Archaic is virtually unknown. However, if lack of water caused the partial or complete depopulation of neighboring regions during this time, the Canadian River Valley could have been an area into which people migrated seeking its riverine resources. The Plains Archaic in general is characterized by a hunting and gathering economy, apparently with an increasing emphasis on plant foods (Wedel, 1961; Willey, 1966) which might have been relatively plentiful in the better-watered stream and river bottoms.

The best-known period in this area is the Neo-Indian, specifically between A.D. 1200 and A.D. 1450, when fully sedentary agricultural villages are found along with Canadian River and its tributaries. These sites are included in the Panhandle Aspect of the Plains village tradition, and are characterized by Puebloan architecture associated with a typical Plains village material culture (Collins, 1971; Lintz, 1978; Wedel, 1961). The antecedents of the Panhandle Aspect are poorly understood, as research has concentrated on the latest, most spectacular developments. However, Lintz (1978) sees some evidence for local development out of the virtually unknown preceding Woodland period (cf. Hughes, 1962). The "smaller drainages and upland dunes" (Lintz, 1978:50) of the area, which have not been investigated, may contain most of the sites of this early agricultural period.

A variety of sites are known which date from the later period, ranging from single room houses to fairly large villages. Panhandle Aspect sites tend to be located on terraces or ridges adjacent to the Canadian River and its tributaries. Some larger sites on steep mesas are known. Agriculture was practiced in valley bottoms (Collins, 1971; Lintz, 1978; Wedel, 1961). Bison hunting was an important activity, and probably occurred principally on the neighboring Panhandle High Plains and Llano Estacado (Lintz, 1978).

The Panhandle Aspect people had abandoned the Canadian Valley by the Historic period (Wedel, 1961), possibly because of conflicts with the southward-migrating Apache. The Historic period is largely unknown, but the hunting and gathering, and at least partially agricultural adaptations of the historic Apache and Comanche, suggest parallels with subsistence/settlement patterns in earlier periods. Spanish explorers recorded semi-permanent Apache farming villages of flat-topped houses (Wedel, 1961).

Sensitive areas in the Canadian River Valley can be defined as follows. Village sites can be expected on terraces, ridge tops, and mesas overlooking streams and rivers. Bottomlands adjacent to streams will contain remains from farming, as well as camps and kill sites from all periods. Gullies and blind canyons would have been favored areas for animal traps and kill sites, definitely from the Paleo- and Neo-Indian periods, and less definitely from the Archaic. Canyons or drainages leading into the neighboring Plains and Llano areas can be expected to contain denser concentrations of hunting-related sites. Steep canyon walls along drainages would also contain caves and rock shelters which have produced substantial amounts of occupational debris in neighboring areas (cf. Wedel, 1961). Crevice and cave burials are also fairly common in canyons in neighboring areas, particularly from the Historic period (Collins, 1971), and should be anticipated here as well. These areas

are also likely to contain rock art (Collins, 1971). Burials from the Panhandle Aspect are found on hilltops adjacent to villages (Lintz, 1978).

The third region in the study area is the Panhandle High Plains. Systematic work in this area has been virtually non-existent and, consequently, recorded sites are few (Jack Hughes, personal communication). Research in the neighboring Oklahoma Panhandle has focused largely on the Panhandle Aspect occupation along the North Canadian (or Beaver) river (e.g., Lintz, 1976; Watson, 1950).

Cultural periods in this area are similar to those of the two regions just discussed. Site types and distributions are largely tied to two kinds of features: water sources and natural animal traps. Both kill and camp sites from all periods can be expected in these areas. Mesa/butte tops, and rock shelters or caves in their sides should contain extensive campsites from any period.

The fourth sub-area is the Pecos River Valley in eastern New Mexico, comprised of a series of stream terraces along the Pecos River adjoining a relatively flat plain to the east, between the river and the Llano Estacado, known as the Mescalero Pediment. Like the rest of the study area, the Pecos Valley has been the focus of very little systematic research. The little which is known, however, suggests that, although the area had clear connections with the better known Southwestern cultures, it was nonetheless distinct from them (Schermer, personal communication; Jelinek, 1967).

Evidence for the Paleo-Indian occupation is limited to isolated finds of projectile points (Jelinek, 1967), although a number of known camp and kill sites are relatively close to the valley, and fairly extensive Paleo-Indian activity has been documented in the Rio Grande Valley to the west (Judge, 1973). There is some possibility that geological processes in the Pecos Valley have destroyed most of the Paleoindian sites there (Jelinek, 1967:140), but this remains to be demonstrated. The permanent water in the valley would have been a powerful attraction for hunters and gatherers at this time. Subsistence and settlement patterns during this period can be assumed to be similar to that of the adjacent parts of the study area; that is, strongly tied to areas near sources of water.

The Pecos Valley appears to have been occupied throughout the Archaic period by hunters and gatherers. Jelinek (1967) suggests that the early Archaic populations in the area were more closely linked to the Southwest while the later populations were more similar to those on the Plains, but little is known about the adaptations of either group. The nearby Llano Estacado may have been an important hunting area during this period, making important those canyons which offered relatively easy routes east.

From approximately A.D. 800 to A.D. 1350, the Pecos Valley was occupied by increasingly sedentary agriculturalists, reaching a peak population density between A.D. 1000 and A.D. 1250. Permanent sites from this period, including multiple-room and subsurface slab-based structures, occur on promontories, flat-topped hills, and terraces near modern and ancient rivers. Farming was practiced in river and stream bottoms, and larger sites tend to occur adjacent to large amounts of bottomland. Hunting remained important, however, and temporary camps occur near water sources on the Mescalero Pediment and up onto the Llano Estacado.

Between A.D. 1250 and A.D. 1350, agriculture was progressivley deemphasized and finally abandoned, even though conditions became more favorable for farming at this time. Inhabitants may have been taking advantage of the expansion in the size and range of the bison herds which occurred as a result of this same climatic shift. This appears to have led the Pecos Valley people out onto the High Plains (Jelinek, 1967). The Pecos River Valley was empty when the Spanish crossed it in 1541 (Collins, 1971; Jelinek, 1967).

The baseline data consists of 2,190 sites and isolates from Texas and New Mexico. Figure 3.3.3.10-1 illustrates major concentrations of this data. This data was collected from the literature, and from an examination of field notes and site records on file at various Texas institutions. This information was used as the basis for describing the prehistory and history of the region.

Of this data base, 162 sites had been recorded with systematic techniques that allow the calculation of site densities for various environmental strata within the M-X study area. An absence of data for the "River" and "Playa" strata necessitated an assumption of their site densities. The high density for the "River" stratum seems justified by the permanence of this water supply over the entire span of occupation in the study area. The "Playa" density was chosen to reflect known prehistoric use of these water sources.

STRATUM	DENSITY (sites per sq mi)
Draws/Streams	5.00
Lakes (very large playas)	7.80
Sand hills	8.80
Caprock escarpment	5.80
Open plains	0.23
River	12.00
Playas (small)	3.85

The data base suffers from a number of problems. First and most important, the data utilized in the calculation of site densities are few, and were collected primarily from the Southern periphery of the study area. No systematically-collected information is available for the Panhandle High Plains subsection of the study area, for the northern two-thirds of the Pecos River Valley, or for most of the Llano Estacado. These problems introduce a large amount of uncertainty into the extrapolation of site densities to the study area as a whole. A sample survey in the northern portion of the study area was recently inaugurated in order to obtain more data on the distribution and density of sites in this area. The survey is not yet completed, but preliminary reports from the field indicate site densities in stream valleys may be higher than that given for the "Draws/Streams" stratum. The "Playa" site density given above so far seems to be relatively accurate. Higher densities in the "Draws/Stream" stratum will, of course, raise the number of sites predicted to be impacted. The extent of this revision is presently unknown, but the density would have to be double the present prediction for there to be a significant change in the direct ranking of this alternative.

Historical and Architectural Resources (3.3.3.10.3)

Despite a large number of recorded non-aboriginal historic sites on the South Plains (Hughes, personal communication) and fairly extensive historic records for the area, very little is known about the resources there. There has been virtually no systematic investigation of non-Indian material remaining in the area; a recent summary of Llano Estacado research (Hughes and Wiley, 1978) was able to catalog only five investigations of historic Euro-American sites. Therefore it is difficult to make concrete statements regarding sites in particular regions.

The nature of the historic resources on the South Plains is suggested by the nature of the historic sites on the National Register (Figure 3.3.3.10-1). Most of these sites are homes, stores, or governmental buildings in existing towns. These buildings date to the later period of Anglo dominance in the area. The Register also includes ranch houses which probably date to the initial period of Anglo dominance, and isolated dugouts which could belong to the Spanish or later periods. However, small early Anglo villages are also known, particularly in or near re-entrant canyons along the edges of the Llano Estacado.

Some historical resources are primarily significant for architectural reasons. Although no comprehensive survey of this category of resources in the Texas/New Mexico region currently exists, several incomplete lists are available. These include the Texas and New Mexico State Registers of Historic Places and the Texas Tech University Historic Engineering Sites Inventory. The New Mexico State Register contains very few properties in the study area. However, the other two listings are extensive enough to provide a general description of the types of properties which might be determined to be architecturally significant. Appendix C of ETR-23 is a list of these properties. Section 3.3 of ETR-23 contains an expanded discussion of historic and architectural properties in Texas/New Mexico.

Paleontological Resources (3.3.3.10.4)

Important vertebrate fauna resources are found in the upper 150 ft of the Ogallala in Hemphill County west of the project area.

Almost the entire deployment area in Texas and New Mexico is underlain by the Pliocene Ogallala Formation. There are occasional Pleistocene terrace deposits along the margins of the Ogallala and Pleistocene lake deposits on the surface. These Pleistocene deposits on top of the Ogallala contain fossils associated with paleo-Indian artifacts. In places, river channels have eroded through the Ogallala to the underlying Paleozoic or Triassic rocks exposing some fossil bearing units.

In the New Mexico area, vertebrate remains are scarce. The most common fossils are mollusks, gastropods, and seeds. Seeds are the most widespread fossils in the Ogallala in New Mexico and even these are uncommon (Leonard and Frye, 1970). The two areas of paleontological significance near the M-X deployment area in Donley and Hemphill counties are 60 to 80 mi east of the proposed location. The two areas are the type locales for vertebrate zone fossils of the Pliocene and the early Pleistocene age. The presence of these locations should not constrain the placement of the operating bases.

Construction Resources (3.3.3.11)

The M-X system will require substantial quantities of a number of construction resources. The resources that are discussed in more detail were selected because of the large quantity required, such as lumber; the possibility of scarcity, such as asphaltic oil and cement; or a combination of both, such as aggregate and water. These resources are personnel, water, cement, steel, asphaltic oil, aggregate, and lumber. Personnel is discussed in Chapter 2 and ETRs 27 and 31. Water is discussed in Chapter 2 and ETR-12.

Cement (3.3.3.11.1)

Under the assumption that M-X is deployed in Texas/New Mexico, the regional cement supply is as shown in Table 3.3.3.11-1. The supply is in excess of the demand and in most cases the state potential production is greater than the actual production, leaving residual capacity (Table 3.3.3.11-2). Additional information can be found in ETR-25.

Steel (3.3.3.11.2)

Most of the steel used by the M-X system will be reinforcing bar steel (rebar) employed in reinforced concrete construction. The production of rebar takes place in plants much smaller in size than iron and steel plants and much more frequent in their geographical distribution. Producers of rebar exist in a number of states considered to be within the M-X supply region: California, Oregon, Washington, Utah, Arizona, and Colorado. Their combined estimated capacity as of 1979 was over 1.5 million tons annually, which exceeds the regional consumption by over half a million tons.

With deployment in Texas/New Mexico, the available supply of rebar increases with the addition of suppliers in Texas and Alabama. Their combined addition amounts to an excess of 1.25 million tons, more than double the apparent 1978 regional consumption of just over 630,000 tons.

Asphaltic Oil (3.3.3.11.3)

The demand for asphaltic oil originates from two sources: as a component of the asphalt surface for the DTN, of which it makes up 5.6 percent by weight; and as road bed coating and sealing oil. Approximately 75 percent of the asphaltic oil produced in the United States is used for various types of pavement construction, such as roads, streets, and parking lots. In 1980, pavement construction was low enough that the asphaltic oil producers reduced their production to about 75 percent of their capacity. Although there are indications that pavement construction will increase, the demand for asphaltic oil will not approach the refinery capacity to produce it.

In the Texas/New Mexico region, five states are probable asphaltic oil suppliers. These states are Texas, New Mexico, Colorado, Oklahoma, and Louisiana. As of January 1, 1981, these five states have a total annual asphalt production capacity of almost 2.1 billion gal, or 7.7 million tons (Oil and Gas Journal, March 30, 1981). The total demand for asphaltic oil for the M-X system is about 0.12 billion gal, or 0.5 million tons, over an eight-year period. This total demand represents

Table 3.3.3.11-1. Texas/New Mexico market area production of portland cement by district, 1960-1978 (thousands of tons).

Year	Louisiana and Mississippi	Missouri	Kansas	Oklahoma and Arkansas	Texas	Colorado, Arizona, Utah, and New Mexico	Total
1960	1,366	2,370	1,503	1,345	4,359	2,238	13,181
1961	1,243	2,244	1,566	1,709	4,678	2,581	14,021
1962	1,480	2,301	1,548	1,802	4,970	2,550	14,651
1963	1,583	2,386	1,550	2,124	5,479	2,549	15,671
1964	1,701	2,331	1,567	2,144	5,600	2,413	15,756
1965	1,696	2,627	1,669	2,274	5,784	2,222	16,272
1966	1,739	2,623	1,724	2,353	5,919	2,191	16,549
1967	1,681	2,798	1,696	2,325	6,067	2,063	16,630
1968	1,578	3,723	1,858	2,366	6,421	2,274	18,220
1969	1,427	3,921	1,830	2,421	6,734	2,263	18,596
1970	1,289	3,897	1,687	2,083	6,501	2,598	18,055
1971	1,486	4,144	1,799	2,374	7,138	2,954	19,895
1972	1,602	4,329	1,986	2,604	7,884	3,145	21,550
1973	1,479	4,359	2,036	2,746	8,312	3,441	22,373
1974	1,699	4,298	1,996	2,695	9,961	3,351	24,000
1975	1,330	3,919	1,835	2,232	7,074	3,295	19,685
1976	1,551	4,334	1,950	2,620	7,438	3,524	21,417
1977	1,538	4,551	2,072	2,771	8,223	3,858	23,013
1978	1,586	4,620	2,063	2,774	8,624	3,899	23,566

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Source: U.S. Department of the Interior, Bureau of Mines, Minerals Yearbook, 1979.

Table 3.3.3.11-2. Portland cement capacity utilization, Texas/New Mexico market area, 1973-1978 (percent).

Year	Louisiana and Mississippi	Missouri	Kansas	Oklahoma and Arkansas	Texas	Colorado, Arizona, Utah, and New Mexico
1973	79.5	90.4	95.1	80.9	83.9	72.4
1974	64.2	83.4	92.0	78.3	79.2	62.3
1975	50.2	76.1	78.3	64.6	71.1	57.9
1976	70.7	83.8	83.8	75.6	76.5	62.1
1977	77.1	87.3	88.5	80.9	84.3	71.7
1978	79.6	89.4	85.5	80.4	79.3	70.3
Six Year Average	70.2	85.1	87.2	76.8	79.1	66.1

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Source: U.S.Department of the Interior, Bureau of Mines, Minerals Yearbook, 1979.

only about 5 percent of production capacity for a single year. There should be no problems in obtaining all the asphaltic oil needed for M-X construction in Texas/New Mexico.

Aggregate (3.3.3.11.4)

Aggregate is a naturally occuring resource that is transported only relatively short distances because of its low commercial value and bulky nature. The estimated total amount of aggregate required for M-X construction in the Texas/New Mexico region would be approximately 51 million cu yd, or 100 million tons for full deployment (Alternative 7) (split deployment in Texas/New Mexico would require about one-half the amount).

Technical reports provided by the Corps of Engineers estimate that limited amounts of aggregate are readily available in the proposed Texas/New Mexico deployment area. These reports were prepared from a limited data base, but they estimated both known and potential reserves of caliche, sand, and gravel in the deployment area to be approximately 100 million tons, as stated above.

The 1972, New Mexico Highway Department Geology and Aggregate Resources report for District II (Southeastern New Mexico), however, indicates reserves of caliche alone in excess of 100 million tons that could be used as aggregate material. Although exact amounts are unknown, these caliche deposits could contribute significant amounts of road-base material when processed. In addition, this same report indicates the presence of large reserves of fine sand with significantly lesseor reserves of coarse sand and gravel.

Because aggregate is a non-renewable resource it was decided that a conservative approach should be taken and the Corps of Engineers estimates were utilized to evaluate impacts. A high impact on construction resources, particularly in comparison with the Nevada/Utah region, was therefore assigned to deployment in the Texas/New Mexico region; while under split deployment a moderate impact was assigned. Further studies could be accomplished in subsequent tiered decision-making processes to better ascertain the exact extent of aggregate sources in the proposed Texas/New Mexico deployment area. If the results of these studies indicate greater amounts of aggregate is available than was estimated in the Corps of Engineers reports, the impact of construction aggregate on the program will be reevaluated.

Lumber (3.3.3.11.5)

The requirement for lumber in Texas/New Mexico is the same as for Nevada/Utah: a total demand for about 43 million board-ft and a peak-year demand of about 10 million board-ft (see subsection 3.2.3.11.5).

In addition to the statistics stated in subsection 3.2.3.11.5, the "1979 Statistical Year Book of the Western Lumber Industry" states that New Mexico mills produced over 220 million board-ft in 1979. In 1977, 13 mills in Texas produced about 310 million board-ft. There is no indication that sufficient lumber supplies will not be available, nor that the M-X demand will increase lumber prices by itself.

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